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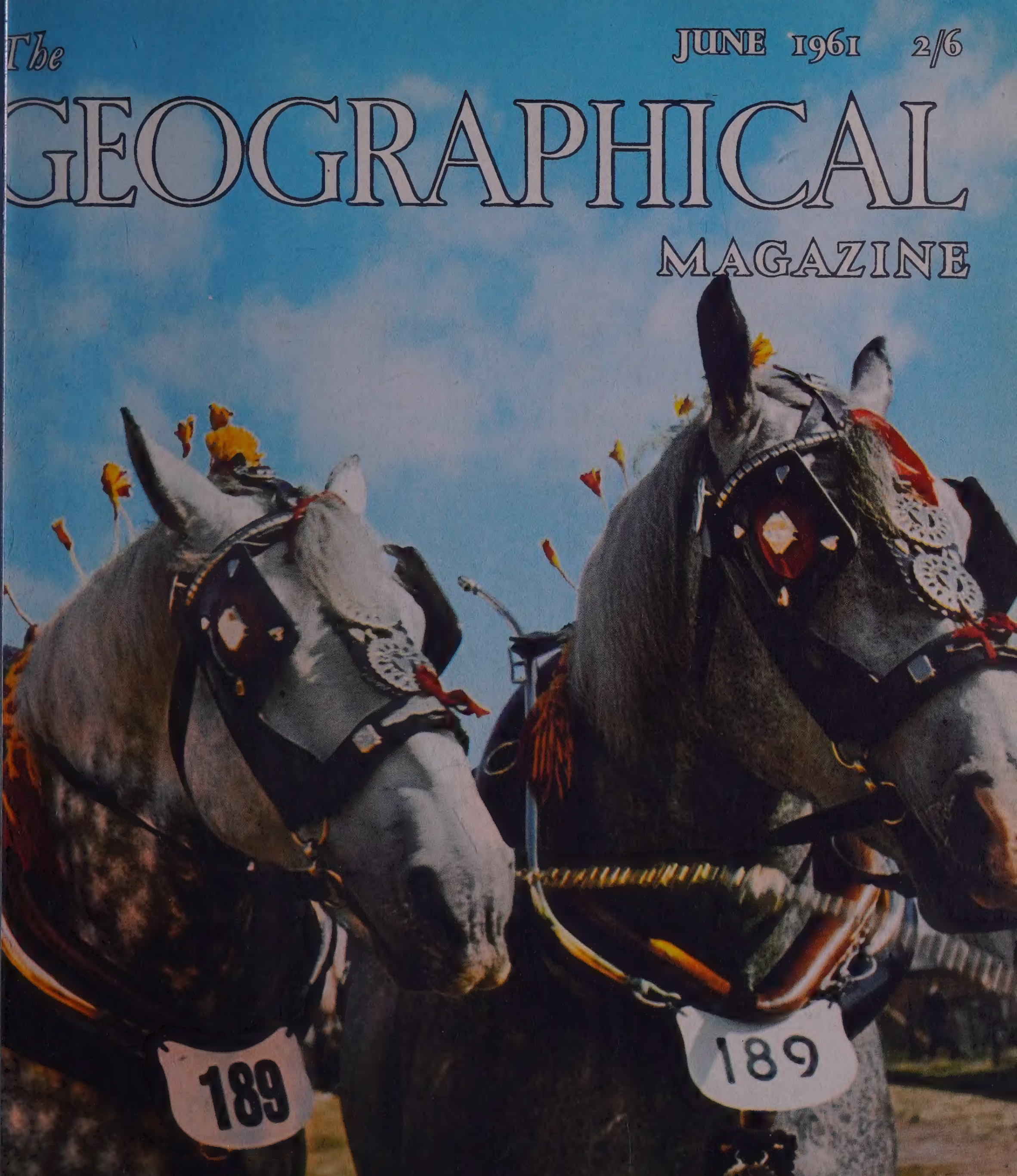
The GEOGRAPHICAL MAGAZINE



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Theories of the Universe

by COLIN A. RONAN

THE pageant of the heavens has intrigued mankind from the earliest times, and has presented him with a continual challenge. The stars, always beyond his reach, have posed many questions; their physical nature, the distance into space to which they extend, their number and whether they are moving or standing still, are all problems to which answers have been sought. In more recent times even the question of how the stars and, indeed, the whole universe came into being has attracted the attention of the scientist. It has taken many centuries for anything approaching a detailed picture to be built up, but since the invention of the telescope in the 17th century, the use of photography and other techniques in the 19th, and the development within the last two decades of radio-astronomy, our knowledge has moved ahead at an ever increasing pace. We now know the answers to some of these questions, but how and when the universe began we still do not know for certain, although present-day astronomers have, at least, some firm ideas on the subject. However, to appreciate these ideas we must begin by sketching, very briefly, the general picture of the universe as we now believe it to be.

First, it must be remembered that the Earth on which we live is, from the astronomical point of view, merely a small body spinning daily on its axis and annually circling round the Sun. With it travel eight other planets and a host of tiny fragmentary planetary bits and pieces known as asteroids; until a little more than two hundred years ago, this 'solar system' was the primary object of study among astronomers. When, at last, the distances of the Sun and planets became known with any real accuracy, it was seen that they were incredibly vast by terrestrial standards, but it has since become clear that the whole system of the Sun's family is but a microcosm in the immensity of space. The distance from the Earth to the Sun is 93,000,000 miles, a distance approximately equivalent to circumnavigating the Earth 3600 times, over which light takes eight and a half minutes to travel; yet vast though this is, we find that the distance to the next nearest star—for it must be remembered that the Sun itself is a star—is such that its light takes more than four years to reach us. This distance is almost 60,000 times as great as that to the Sun, yet it has been found to be in no way exceptional; in fact every star is, in general, separated from every other star by a similar amount.

We now also know that the stars, differing though they do in brightness and size, are all in motion. Each star has an individual motion of its own and, at the same time, takes part in a general rotation about a central point which lies in the direction of the constellation of Sagittarius (the Archer). When looked at in the sky Sagittarius appears to lie across that hazy band of light which we call the Milky Way; in fact it lies between the Earth and the Milky Way itself, and the latter, far from being just a hazy light, is seen in the telescope to be a great conglomeration of stars and gas and interstellar dust. It is this great concourse of stars, gas and dust which is in rotation and of which every star we see in the sky is a part, so that we now know that the solar system and the whole night sky which we can see with our unaided eyes is part and parcel of the Milky Way, or the Galaxy as it is called. The Galaxy is shaped rather like a Catherine wheel having a thick central portion, and its size is such as to beggar the imagination. Light takes 100,000 years to cross it from one side to the other and about 20,000 years to travel through the thicker centre parts; our Sun lies in one of the spiral arms of the 'Catherine wheel', and light takes some 30,000 years to travel between it and the centre of the Galaxy.

We on the Earth are, then, an integral part of the Galaxy. The Sun, a huge globe of glowing gas more than a hundred times larger in diameter than the Earth, is itself but one of the myriads of similar bodies which go to make up the contents of the Galaxy. What is more, the Sun is in no way exceptional in size or luminosity: many stars are larger and many, too, are intrinsically very much brighter. Yet all these glowing spheres of gas are only part of what the Galaxy contains, for besides stars and, possibly, planets circling round at least some of them—planets like those round our own Sun which we see only because they reflect the light of their parent star—there is much dust and gas. The 'dust clouds', as we can conveniently call them, are vast in extent, and while they obscure light from the stars lying behind them they are transparent to radio waves and can, therefore, be 'penetrated' by radio telescopes. They extend for distances of hundreds of billions of miles and are continually on the move like the rest of the material in the Galaxy; in addition the stars, in their own ceaseless rotation around the Galaxy's centre, pass through them and probably 'sweep up' some of this material. Gas, uncondensed into stars and glowing either on its own account or because of the stars embedded in it, can also be seen in the telescope and observed by radio astronomers; like the dust clouds it is in motion and extends over immense areas.

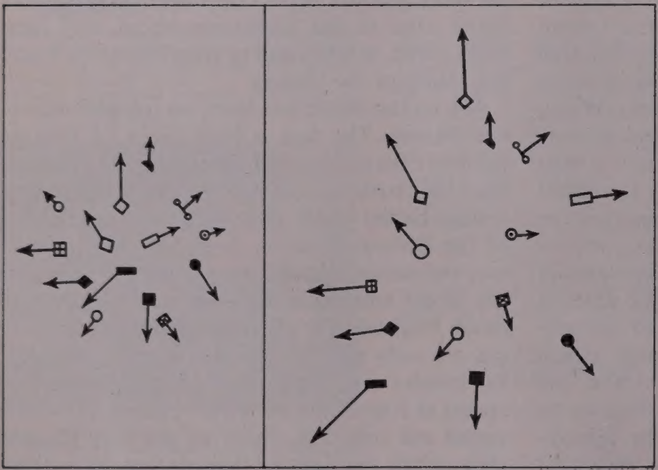
Our own Galaxy is not the only one in the universe, and observations during this century have made it clear that the number of galaxies which exist in it are legion and can only be numbered in hundreds of millions. The universe is, therefore, much larger than ever imagined in earlier times and, on closer examination, presents many new problems to the astronomer. It is to these problems that we must now turn in order to come to grips with the question of the beginning of the universe. Admittedly the modern cosmologist no longer thinks of space in the everyday terms of distance, direction or perspective, nor does he use the type of geometry we learned at school to express his ideas; but we can nevertheless obtain a general idea of the lay-out of the universe without having to understand the new higher mathematics of the nature of space or the other intricacies involved.

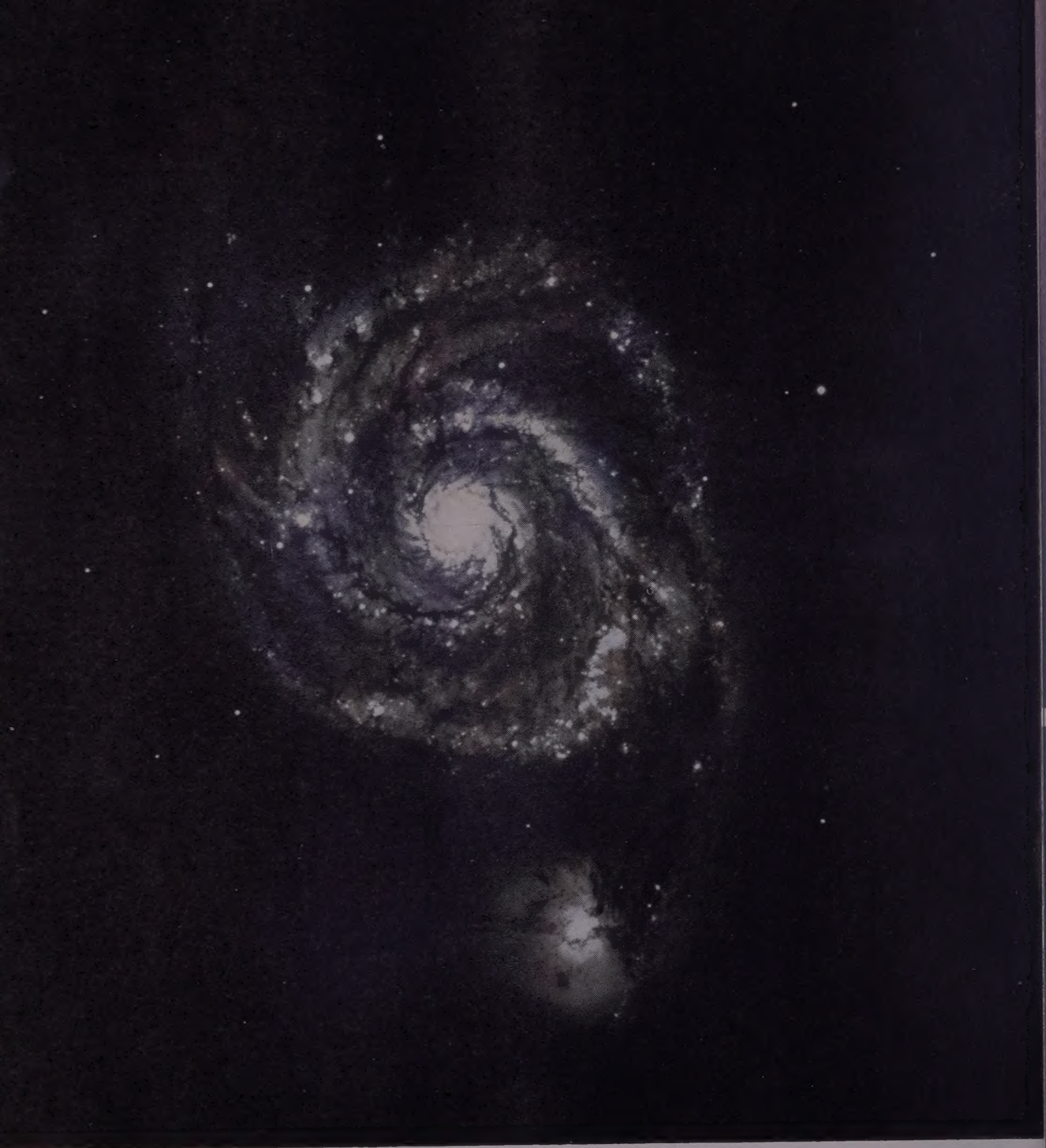
(*Opposite*) A cloud of stars in the constellation of Sagittarius. It lies, an area of many stars, towards the centre of our Galaxy. The curious dark areas are caused by interstellar dust, which obscures the stars behind: they are not really 'holes' in the star cloud

An examination of the galaxies by splitting up their light in a spectroscope shows that in virtually every instance the colour of the light emitted by their atoms is more red than it should be. Such a 'red shift' is, for good reasons, interpreted as meaning that the galaxies are all moving away from us; in addition there is evidence that the further off in space they lie, the faster they are travelling. This has led to the idea that the universe is expanding, for although attempts have been made to find other explanations for what is observed in the spectroscope, no generally acceptable ideas have been forthcoming. The concept of an expanding universe has, therefore, come to stay, and the reason why it seems to fit in so well with observation can perhaps best be appreciated if we consider a simplified example. Imagine that a bomb is in the act of bursting: during this time every particle of its broken casing moves outwards and away from every other particle. It would not, therefore, matter which particle we pretend we are on, the result would be the same, namely that every other particle would appear to be moving away from us, even though we are not at all the centre of the explosion.

Yet, one may ask, why should the more distant particles be moving at greater speeds? The answer, in its most simple terms, can be found if we imagine that, as the bomb bursts, all the particles of the casing move apart but at different speeds, for it is clear that after a time the fastest moving particles will be furthest away. It follows that if, during the explosion, we observe from any one particle, we shall find that it is the most distant ones which appear to be receding most quickly from us.

In this diagram of an expanding universe the arrows indicate both the direction of the particles and their speed—the longer the arrow the greater the speed. An observer on any particle (or galaxy) sees the other particles moving away from him. As expansion continues, from the state shown on the left to that on the right, the particles which are moving faster become the ones which are the furthest out





These three long-exposure photographs were taken with the world's largest visual telescope at Mount Palomar, California. They show galaxies something like our own, lying far out in space. (*Above*) Looking down, as it were, on a spiral galaxy in the constellation of Canes Venatici; our own Galaxy is similar in shape, and we and our Sun exist in a spiral arm like one of these. (*Opposite, top*) An edge-on view of a galaxy in Virgo; dust lies densely in its central plane. (*Opposite, bottom*) A group of galaxies which lie at such a distance that their light has taken about 40,000,000 years to reach us. Galaxies have a slightly hazy appearance and an oblong shape, and may be picked out from the much nearer stars of our own Galaxy, which are also seen

Our example breaks down when we consider the particles of the bomb casing which lie at the outside, because in the real universe there is no 'outside' to space. Nevertheless if we consider each galaxy as a particle, then if they were all close together at some distant time in the past and began moving apart with different velocities, it is the fastest moving that we shall see in the most distant parts of space. Such a state of affairs would arise if at 'creation' the material making up the universe was all packed closely together and there was a kind of 'cosmical explosion', the results of which we are now observing. Theories along these lines have been proposed by Abbé Lemaître in Belgium and George Gamow in the United States, and are popularly known as 'big bang' theories. From such theories another point arises: as expansion occurs all particles will move further away from each other, and if we could 'look back' into time we should see the most distant galaxies more clustered together than they now are. It seems strange, but we can actually 'look back' into time; indeed we cannot help doing so when we make observations of the universe, and it is to this aspect of the problem we must now turn.

Earlier in this article reference was made to the number of years light takes to travel the great distances between stars. The term 'light year' is a measure of these distances, one light year being that distance which light travels in one year, that is, 6 billion (6,000,000,000,000) miles. If we see a star which is five light years away, then we are saying that its distance is 5×6 billion, or 30 billion, miles away and that the light from it has taken five years to reach us; which means, of course, that we are not seeing the star as it is now but as it was five years ago. This is true of all celestial bodies; when we look at the Moon we see it as it was a little more than one second previously, and the Sun we see as it was eight and a half minutes before. When, therefore, we observe galaxies so distant that light takes something like 2,000,000,000 years to reach us, we are in fact looking back in time by 2,000,000,000 years. The question now is, do we find that there is evidence that the distribution of galaxies 2,000,000,000 years ago was different from that of more recent times, as shown by those galaxies which lie closer to our own and which are therefore seen less far back in the past? The answer, unfortunately, is that no significant difference can be detected. To discover an answer to the question we must probe out further, but this does not seem to be possible using telescopes and cameras; and not, let it be said, because larger telescopes and more sensitive cameras cannot be made—although their construction is of immense difficulty—but for the simple reason that the Earth's atmosphere, which absorbs and distorts light from space, will render unusable any much larger instruments because this atmospheric action is more noticeable in them. Some other method of probing space must therefore be used.

Happily, since the war, a new means has been developed: the radio waves which stars and galaxies radiate are examined in place of the light which they also emit. The Earth's atmosphere is much less of a nuisance to radio waves; moreover, it has been discovered that galaxies are very strong emitters of radio waves, so that while many are too dim to be observed visually they are, on the other hand, strongly 'visible' in a radio telescope. In some instances a strong radio source has been identified as a light source already seen visually through a telescope. A good example is the strong source of radio waves which lies in the constellation of Cygnus (the Swan). Here it has been found that the radio waves emanate from two galaxies which are touching each other, and we have here either two galaxies in the act of collision or one galaxy which is breaking up into two parts. In any event it is now very clearly possible to penetrate further into space with radio telescopes than can be done by visual means; many radio observations have been made which cannot be checked visually and, as radio telescopes develop, it seems likely that further space penetration will take place.

Nevertheless there would seem to be a limit even to the distance which the radio telescope can 'see', for if, as we believe, the further away a galaxy is the faster it is moving away from us, a point will be reached when the galaxies are moving away faster than the speed of light. At such a point galaxies, however strongly they radiate, will become invisible because their radio waves, which travel at the same velocity as light waves, will themselves become invisible, their radiation never being able to reach us. However, it is only proper to point out that this limit is so far away that observations should still be able one day to provide definite information about the early age of the universe, even though we may never get back as far as 'the beginning'.

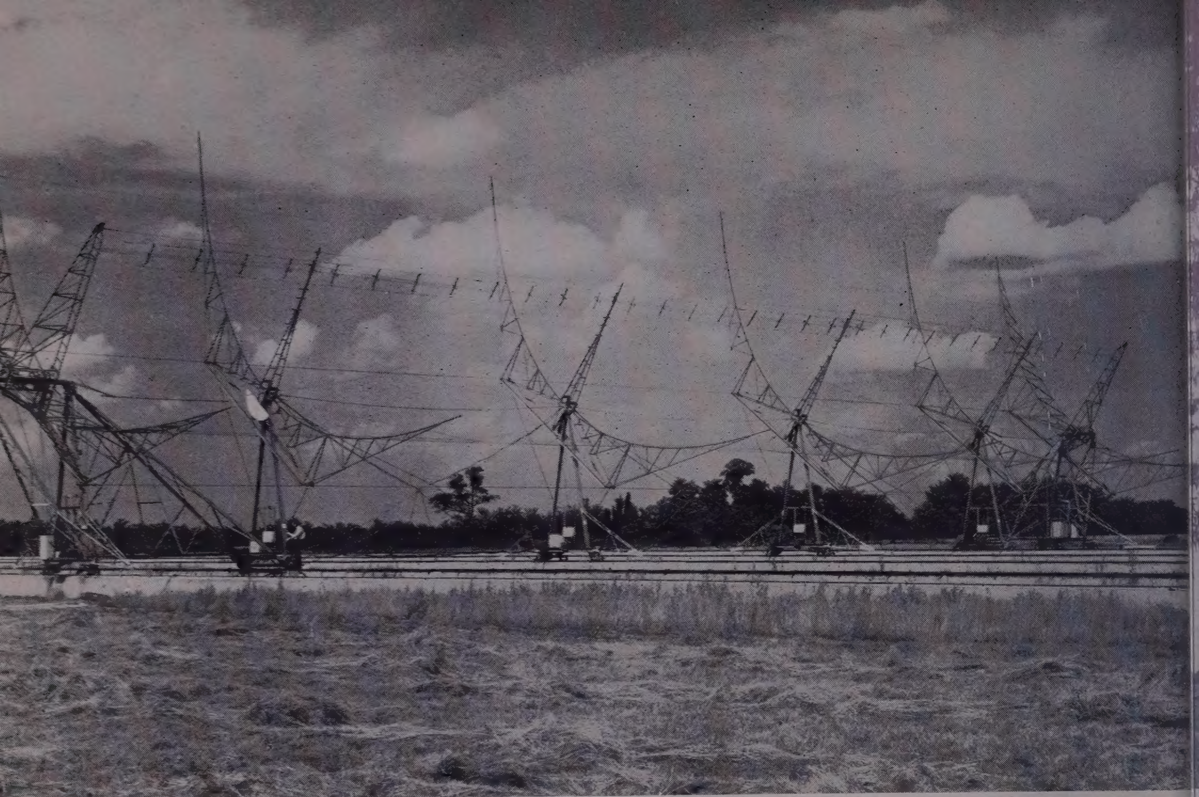
The latest researches by radio astronomers came to public notice last February when

In the constellation of Cygnus is one of the strongest sources of radio waves, though very dim visually. It is either a pair of galaxies in collision, or a single galaxy in the act of splitting in two

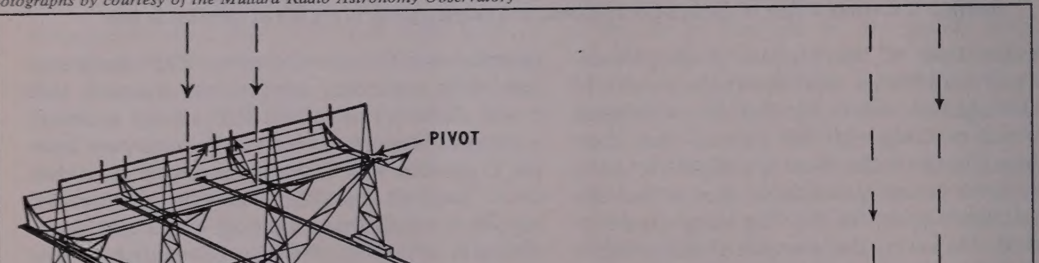
Professor Ryle of the Mullard Radio Observatory at Cambridge announced the results of an investigation which he and his colleagues had been carrying out. He claimed that their observations show that there is a slight crowding of the most distant galaxies, so that at last observational support for the 'big bang' theory is to hand. However, the amount of clustering is small and is not so very different from the distribution of galaxies which would be expected if a different theory of the universe is held. Such a theory, known as the 'steady state', has been under discussion for some years and has been developed by Professors Bondi and Hoyle, Dr Gold and Dr Lyttleton.

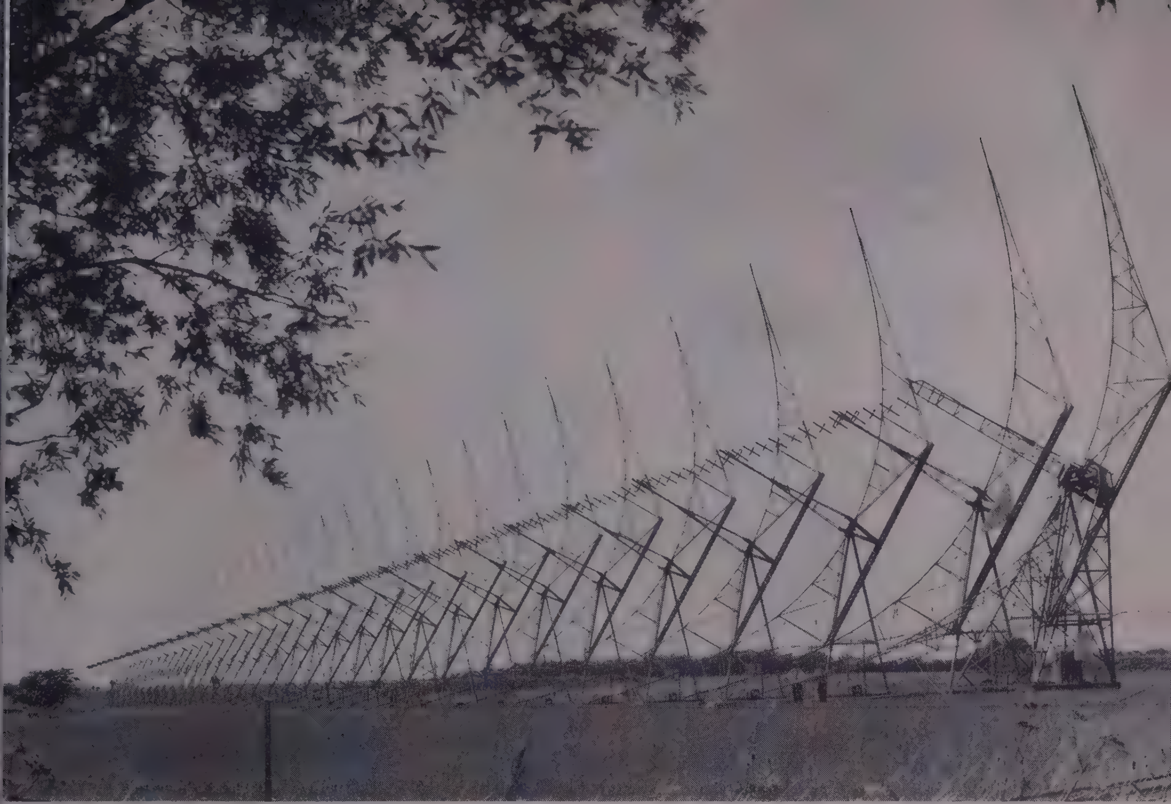
The 'steady state' theory was arrived at after a careful and rigid mathematical analysis of the work of Einstein and others on the theory of relativity. In developing his mathematical equations Einstein had found that there occurred a mathematical expression which was very difficult to interpret in terms of the real physical universe. Those who worked on the 'steady state' theory were able to cancel out this mathematical expression, and the result obtained indicated that, in every given volume of space, the amount of material was for ever the same. The interpretation of the expanding universe was accepted, and it was therefore suggested that atomic material is being continuously created. To keep pace with the expansion which, the theory suggests, is due to a 'natural' repulsion between galaxies (a repulsion which shows up only over really great distances of space), the rate of creation is unobservably small. However, the general outcome of the theory is that from whatever point in the universe we make observations, the universe at large always presents the same general appearance and, what is more, has always done so; as a consequence no crowding of galaxies should ever have occurred however far back into the past we go. Moreover, on this theory every galaxy has a beginning and, perhaps, an end, but the universe as a whole has always existed and never came into being suddenly with a 'big bang' at some distant time in the past.

This theory is very elegant from the mathematical and philosophical points of view, and although it suggests that matter is being continuously created in a way we do not understand and cannot at the present time fathom out, it does avoid a single act of creation which, being a



Both photographs by courtesy of the Mullard Radio Astronomy Observatory





The type of radio telescope known as an interferometer employs two separate arrays of aerials. (*Opposite, bottom*) On the right of the diagram is a large fixed aerial stretching due east and west; on the left is an aerial which can move on a kind of railway track which runs north and south. The aerials can be tilted in order to scan in a north–south direction, and the rotation of the Earth enables them to scan in an east–west direction. This instrument, like the bowl type of radio telescope at Jodrell Bank, collects radio waves and concentrates them onto its aerials. (*Opposite, top*) The radio interferometer at the Mullard Radio Observatory, Cambridge, has its movable aerial mounted on a 1000-foot track; (*above*) its fixed aerial measures 1450 feet

unique event, cannot itself be subject to scientific analysis. Does it, however, fit in with observation?

Professor Ryle's radio studies show, he claims, that at a distant time in the past, the universe of galaxies was more crowded together than it is now and, therefore, that it does not always present the same physical picture to an observer. On the other hand the amount of crowding of the galaxies so far observed by Professor Ryle is slight and Professors Bondi and Hoyle believe that their theory can account for this change from an even distribution. They believe that what Professor Ryle has observed with such care and brilliant attention to detail *may* be very old galaxies formed by continuous creation long before our own Galaxy and those near by came into existence. This is a view which would put the 'big bang' theory out of court because that theory claims that the very distant galaxies must appear younger than those near by.

To decide the correct interpretation means that more must be discovered about how the radio waves emitted by a galaxy depend on its age. Moreover, in the months ahead Professor Ryle's results will need to be most carefully worked over and the observations which the 'steady state' theory suggests must be expressed as precisely as possible. It will also help if radio observations, penetrating even further into space, are made so that, if it is there, evidence of more intense crowding of galaxies can be obtained.

At the moment the situation appears best to be described as 'not proven', and we must be careful to reserve our judgement as to which theory—the 'big bang' or the 'steady state'—is correct. However, it must be remembered that in due course both theories may, and probably will, be replaced by something more widely embracing, for such is the method whereby science advances.

Naples

by CHARLES LISTER

FROM a distance, serene; as you approach, confusion; and on arrival, chaos: that is Naples today. Its streets are pandemonium, its history, architecture, politics and language are mixture and muddle. It is a seething mediaeval cauldron of barbarism and culture, of darkness and light, where extremes of ugliness and beauty, poverty and riches, vice and virtue, are hopelessly entangled, and in whose people tears and laughter, kindness and cruelty, bravery and cowardice are strangely combined. The comments of visitors, too, reflect the contradictions of Naples; from Shelley's 'Elysian City' to Somerset Maugham's 'most depraved city in Europe'. Yet with all its inconsistency and paradox no town in Italy has so marked a character, and no people so fierce a spirit of individuality and independence.

Set in the beauty of the Bay, Naples is spread fanwise on a crest of hills between the distant headlands of Sorrento and Miseno. Offshore, Capri and Ischia stand like sentinels at the entrance, while in the background towers the threatening cone of Vesuvius. From closer, you see that the ridge Naples is built on sweeps down from the heights of Sant'Elmo to a jagged tip where Castel dell'Ovo rises from the waves. On each side the city slips away to lose itself in fifty miles of crescent coastline and the small attendant towns of Baia, Pozzuoli and Castellamare. Full of warm sunlight and gently caressed by the sea, it is a land as magic and bewitching now as it was to the Greeks three thousand years ago.

Only legend and guesswork anticipate the ancient Greeks here in Siren Land. For this is the setting of the Homeric legends, where Aeneas stepped ashore on his way to Rome, where caves and lakes were the entrance to the underworld, and where the giant causeway found beside the Lucrine Lake became the great road laid by Hercules to drive the Oxen of Geryon across the swamp. Naples itself is the Siren City, called after the soft-voiced enchantress Parthenope who lured men to their deaths on the Galli Isles beyond Sorrento. At last, spurned by Ulysses, she threw herself into the sea, and her body was washed up at the spot which bears her name, Via Partenope.

The Greeks first settled on Ischia about 1000 B.C., later moving to Cuma on the mainland, and then gradually filtering south to build new towns, one of which was Neapolis, the 'New City'. The settlement prospered, and when the Roman Empire pushed south, news of the remarkable alien civilization here quickly spread: government, flourishing trade, public games, and the culture and craftsmanship of ancient Greece. Here too was a luxurious climate, excellent wine and food (particularly oysters) and the miraculous powers of volcanic springs, attractions that soon helped to make it the most popular resort in the Empire. An additional pleasure was the 'aphrodisiac atmosphere' of Naples, an electric quality in the air said to contain 'magic powers of rejuvenation'. Eager to escape from the busy capital, hedonist emperors made this bay their playground, accompanied by a host of rich

J. Allan Cash

'From a distance, serene . . .' The shoreline of the Bay of Naples sweeps round to the point of Santa Lucia and Castel dell'Ovo, before curving away under the distant shadow of Vesuvius

Romans intent on diversion and debauch. For Ovid had told them '*In otia natam Parthenopen*'—'Parthenope was born for leisure'—and they hurried down to taste its delights.

The whole Bay of Naples is full of memories of great Roman names. Augustus bought Capri for his retirement, Tiberius died at Miseno, Nero sang in Naples and murdered his mother at Baia. Virgil wrote part of the Aeneid at Posillipo; Brutus and Cassius plotted on Nisida to murder Caesar, and Lucullus in a villa on Castel dell' Ovo fed living slaves to his pet fish. From Pozzuoli, where St Paul landed on his way to Rome, Caligula built his bridge of boats three and a half miles long to Baia, the most dissolute town of all. Virgil called it 'the golden shore of blest Venus' but Seneca knew it as the 'home of vice', a reputation that had hardly changed a hundred years ago when Sainte-Beuve called it '*La Sodome du Golfe de Naples*'.

From Miseno, the Bay's western point, where the Roman fleet was based, Pliny set out on his fatal voyage in A.D. 79 to relieve Pompeii and Herculaneum; and off the same point Augustus, Antony and Pompey met to divide the world on Caesar's death. The other end of the Bay, now Punta della Campanella, was Promontorium Minervae where a great temple stood, and where

'. . . as you approach, confusion.' From the Vomero (*opposite*) Naples tumbles steeply to the Bay, a cascade of bright concrete and old white-painted stucco

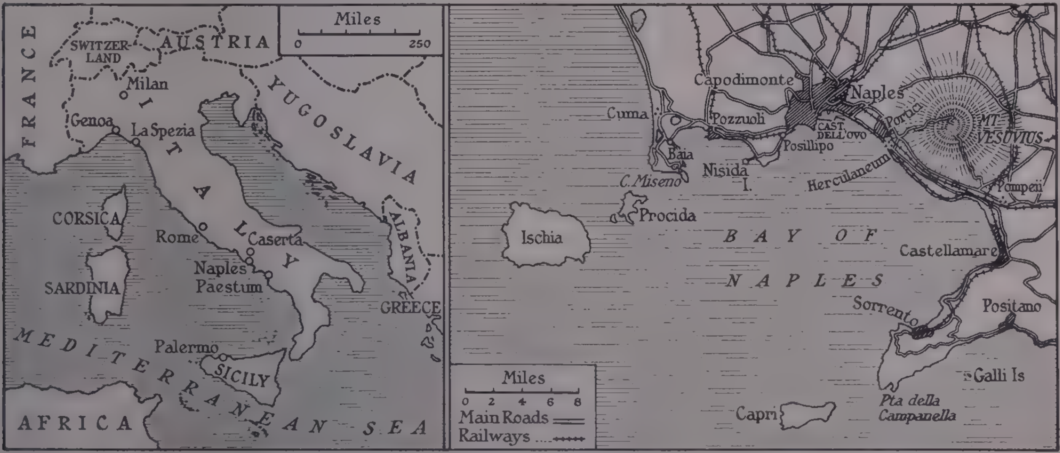
any casual digger can unearth votaries, pieces of statuary, and finely decorated pottery over two thousand years old.

But in Naples itself little of Greece and Rome is left, just a fraction of the Temple of the Dioscuri embedded in the façade of San Paolo Maggiore. The shape of Neapolis is plain, however, at the very centre of the town where a criss-cross pattern of narrow streets marks the outline of the old city. Via Tribunali was the 'decumanus major', 'the main avenue', and Via San Biagio, nicknamed 'Spaccanapoli' or 'Split Naples', was the 'decumanus inferior', 'the lower avenue'. All has changed since then, yet anyone who has seen the temples of Paestum further south can imagine the splendour of old Neapolis on these golden shores.

During the Dark Ages from the 5th century to the 11th, when at last the Normans emerged as rulers of southern Italy, Naples suffered the constant local wars that raged throughout the country. It was a period of famine, violence and destruction and it was only checked by the arrival of the Hohenstaufens in 1160 and Frederick II's choice of Naples as his capital. He eagerly set about making the now dilapidated city worthy of its new appointment; he founded the University in 1224, built the Castel dell'Ovo and the Castel Capuano, extended and rebuilt the city walls, and to Baia he brought back the reputation of medical excellence, first discovered by the Greeks.

The Angevins soon followed, and though cruel and treacherous as rulers they brought further magnificence to the mediaeval capital of south Italy. Charles I enlarged the University, reconstructed the main harbour to increase trade, built the famous church of San Lorenzo just off Via Tribunali, and laid the foundations of two notable landmarks, the Castel Nuovo and Naples Cathedral. But the city's expansion was slow; rulers wanted to destroy the work of their predecessors and build their own monuments on the same sites. Styles of architecture in the old city changed but the narrow, tightly packed alleyways remained the same, dirty, dark and teeming with life, the life Boccaccio revelled in when he lived here in 1331 under the patronage of Robert the Wise. It was in the church of San Lorenzo that he saw 'that lovely lady whose flashing eyes fixed themselves on mine with piercing light': the Princess Maria and daughter of the king. And while Boccaccio roamed the taverns of mediaeval Naples, Giotto painted frescoes in the Castel dell'Ovo and in Santa Chiara, Robert's magnificent new church, and Simone Martini completed the wonderful altar-piece of the king's coronation that is now in the Capodimonte Museum. It was Robert himself who laid the foundations of a new castle, high up overlooking the whole city; it is Sant'Elmo, the first building in that part of Naples now known as the Vomero.

One little corner of Naples was constantly changing, however—Posillipo, the stretch of beautiful rocky headlands just west of the city where rich and noble families chose sites for castles and palaces, building their havens of luxury on every point, so as to breathe the fresh sea air and escape the sordid alleys of the crowded city. Within the walls the fishermen,



A. J. Thornton

Allan Cash

(*Above*) Shining in the sun, new office blocks tower over the tram-lines and trees of the Villa Nazionale gardens along the waterfront; but just behind them lies the true chaos of Naples (*opposite*), a warren of narrow streets festooned with washing where the sun seldom penetrates

sailors, merchants, shop-keepers, craftsmen and traders kept up their busy but wretched lives, still copying the ancient Greeks and living as much as possible out of doors in the sunshine. It was the brilliant luxury introduced in the middle of the 15th century by the Aragonese rulers that inspired the poet Sannazaro to make Naples the setting of his *Arcadia* and call the city 'a piece of heaven fallen to earth', for Alfonso the Magnanimous had just built the great triumphal arch of the Castel Nuovo, and superb banquets were held nightly in the huge Hall of Barons. While the Spaniards feasted, the Neapolitans smouldered in poverty beneath the oppressors' yoke and paid more and more taxes to support the royal finery. They knew that resistance was useless, that the dungeons were always full, and that when the Aragonese caught their enemies they 'cut off their heads and kept them salted in chambers beneath the palaces'. Such was the fate of the rebellious Barons of Apulia who, having been summoned to Naples for a banquet of reconciliation, were all murdered in the middle of the festivities.

The return of the Aragonese to Spain in 1502 was not the end of Spanish domination; Naples fell under the rule of viceroys who had two principal functions, the maintenance of peace and the extortion of wealth, both objectives being pursued with ruthless efficiency. It was one of the darkest periods of Neapolitan history; survival became a matter of opportunism, fitness, favouritism and violence, and in the struggle to exist honest men turned brigand and a host of secret societies sprang up in order to outwit the aggressor. Besides straightforward tyranny, an additional hazard arose in the form of raids by Turkish pirates who constantly plundered the coast and carried off anything they could lay hands on. Against these incursions the many towers and fortresses were built that still stand guard over the Bay, while at Punta della

Campanella the great bell rang out in warning as soon as the Turk Barbarossa's fleet was sighted. For two hundred years Naples virtually remained a prisoner of the Spaniards, and instead of progress there was a return to barbarism. Out of sixty viceroys, Don Pedro of Toledo (1532–53) was the only one to benefit Naples in any way: apart from beating off the Turkish pirates, he provided Naples with its first sanitation since Roman times, demolished many of the worst slum areas, and drove a wide new thoroughfare through the centre of the city, the Toledo, or Via Roma, which runs from the Piazza del Plebiscito right up to the National Museum.

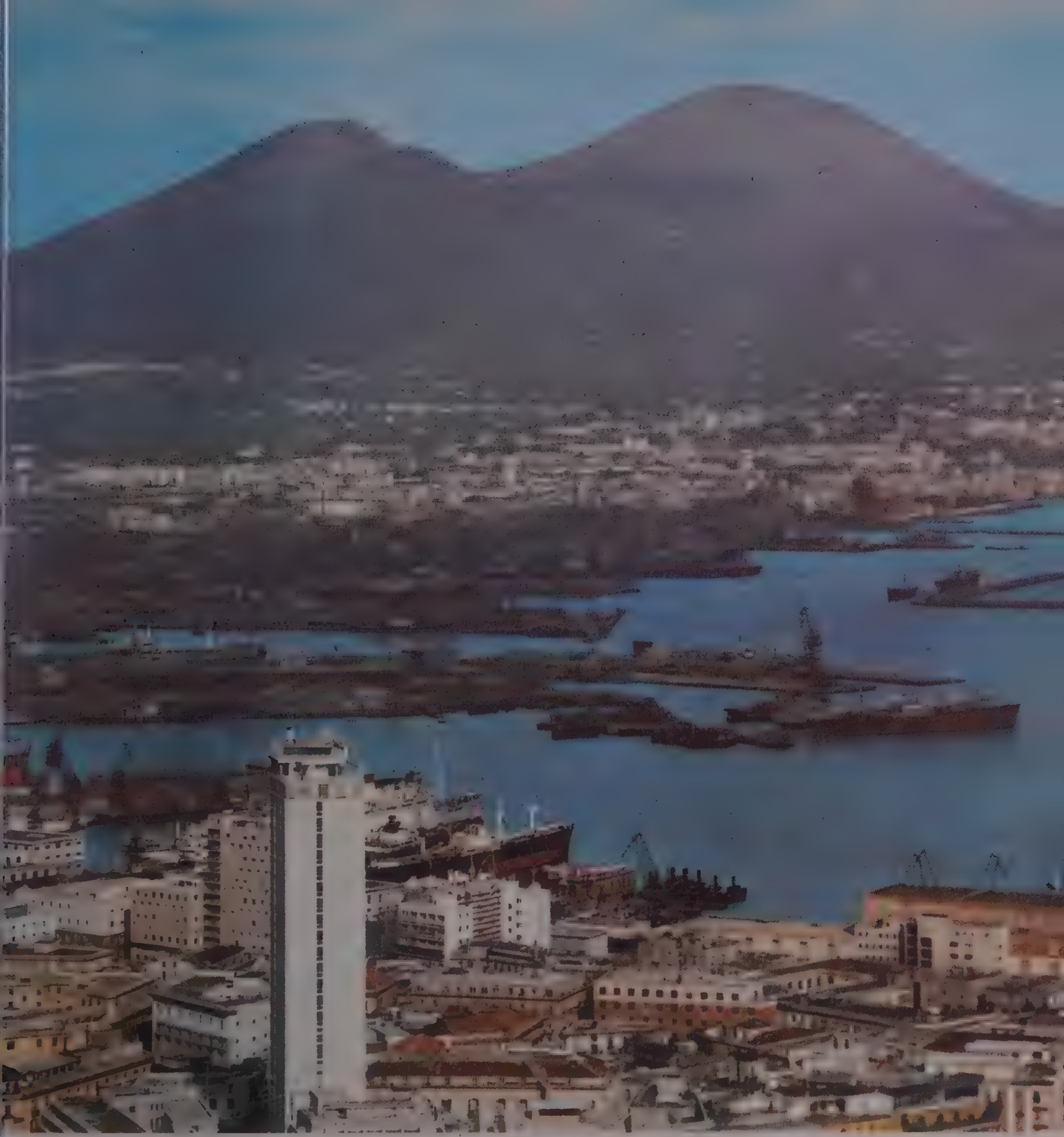
If little good resulted from this long occupation it did mean that Spanish taste and manners pervaded Neapolitan life; art, architecture and even personal behaviour were influenced. The notable baroque buildings of the period are the churches of Gesu Nuovo, San Paolo, San Domenico and San Gregorio Armeno, all delightful examples of lavish and ingenious elaboration. To decorate the interiors came painters such as Caravaggio, Guido Reni, Ribera and Solimena, whose many works are scattered throughout Naples, though the finest collection is in San Martino and the adjacent museum.

A few grandiose buildings and the deliberate ostentation of Spanish manners did not change the essential fickleness of the Neapolitan character. In 1647 they hailed the rough fisherman Masaniello as a hero for leading a successful revolution against the viceroy; a month later they were equally overjoyed to see him shot. It was the same at the beginning of the 18th century when Spain, France, Austria and the Bourbons each held the kingdom in turn—all were greeted with equal delight. But with the Bourbons, Naples had a resident monarch once again, a cause for great joy, though only one member of this bizarre family behaved at all like a king.

This was Charles, who came to the throne in 1734 and promptly set out to repair all the damage of the viceregency. Waging war against banditry, racketeering and vandalism, he encouraged trade and commerce, built a large number of roads,

From this quay 30,000 southern Italian emigrants leave each year to look for a new life abroad

J. Allan Cash



tachrome

Bernard G. Silberstein, from Camera Press

Naples is the second largest port in Italy. Although it suffered severe damage in World War II, its harbour installations have been rebuilt and once again it enjoys a thriving international trade

A typical *salita*, or *gradina*. As so much of Naples is built on a hillside, stairways between the houses are a common feature. It is possible to climb on foot from the harbour to Castel Sant'Elmo and beyond, and there are even four mountain railways in the town

y Hearne, from Pictorial Press

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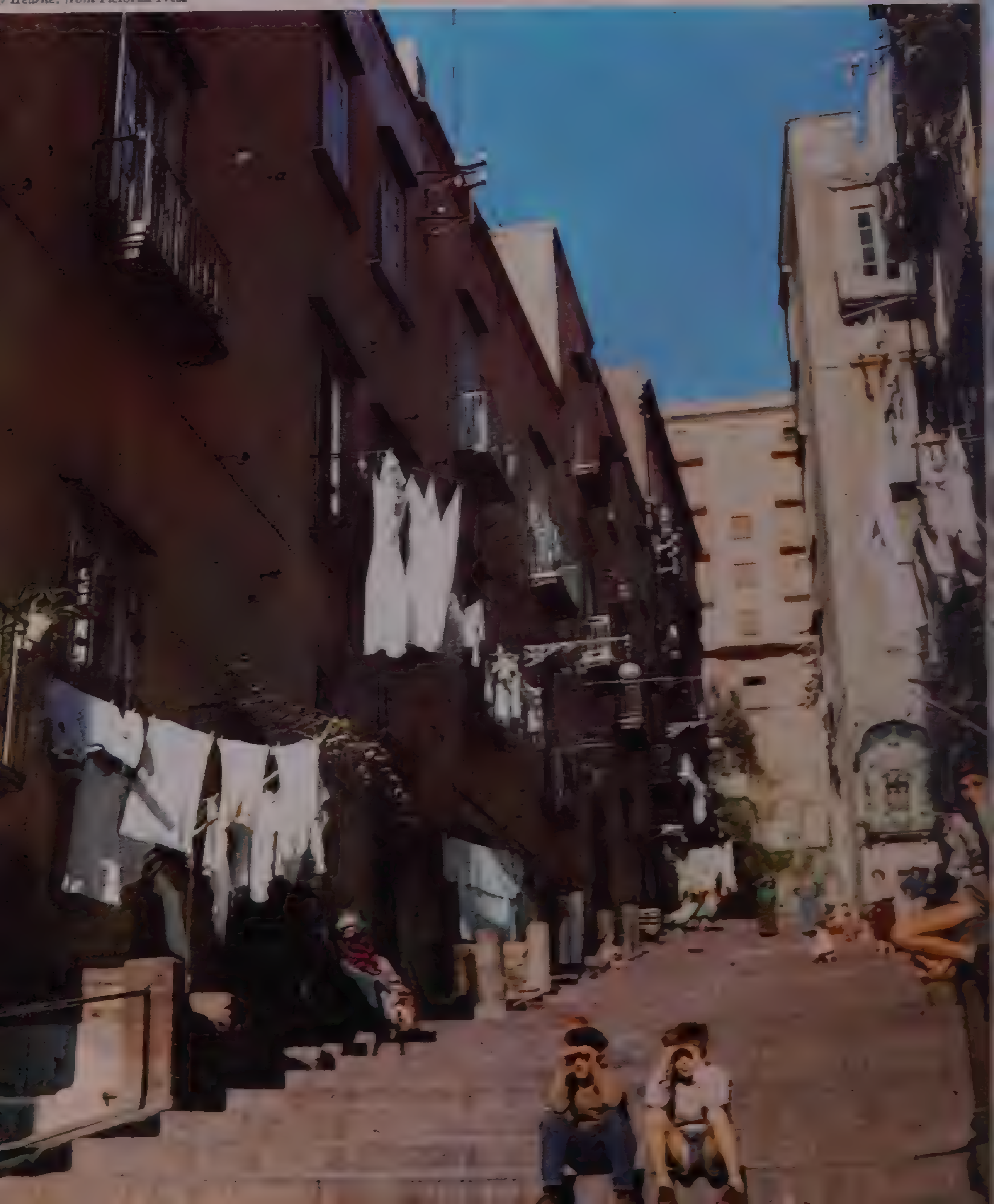
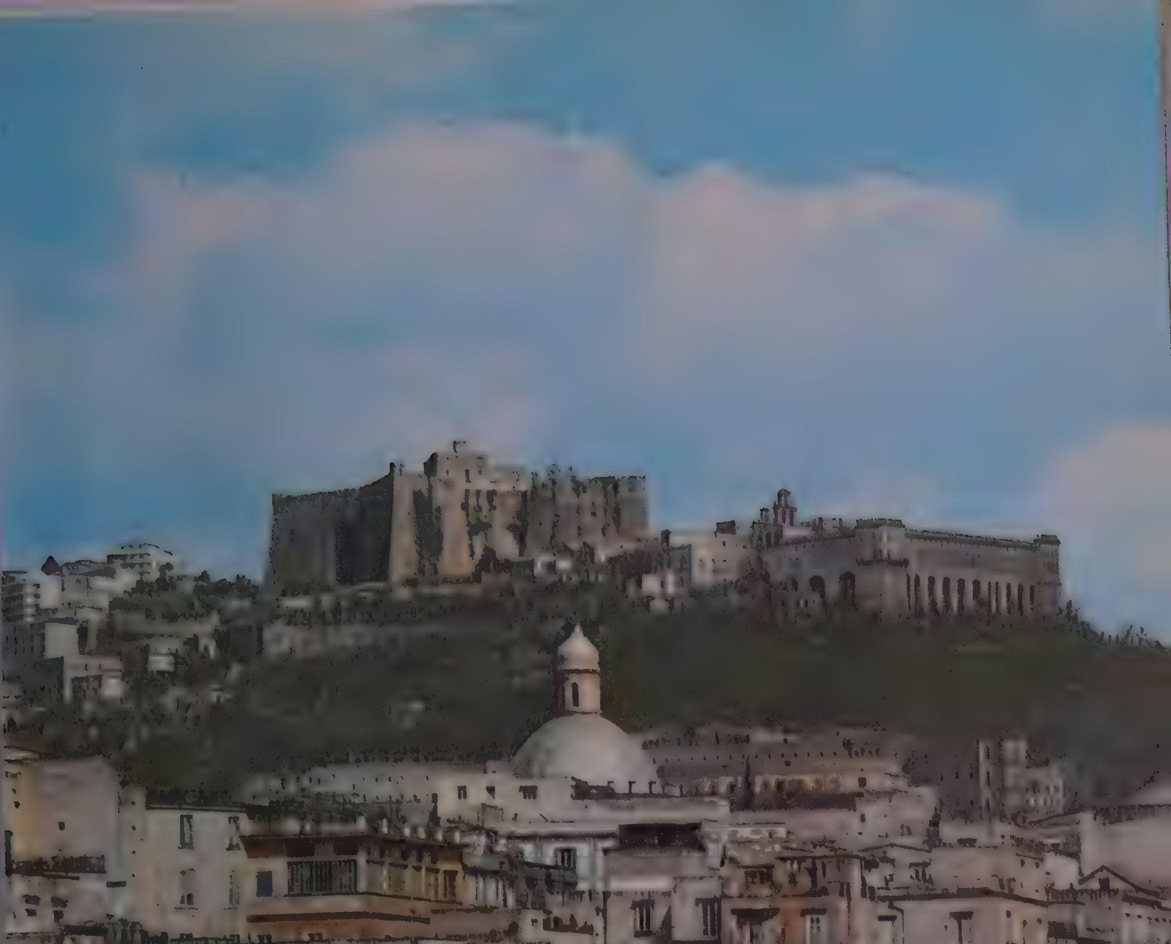
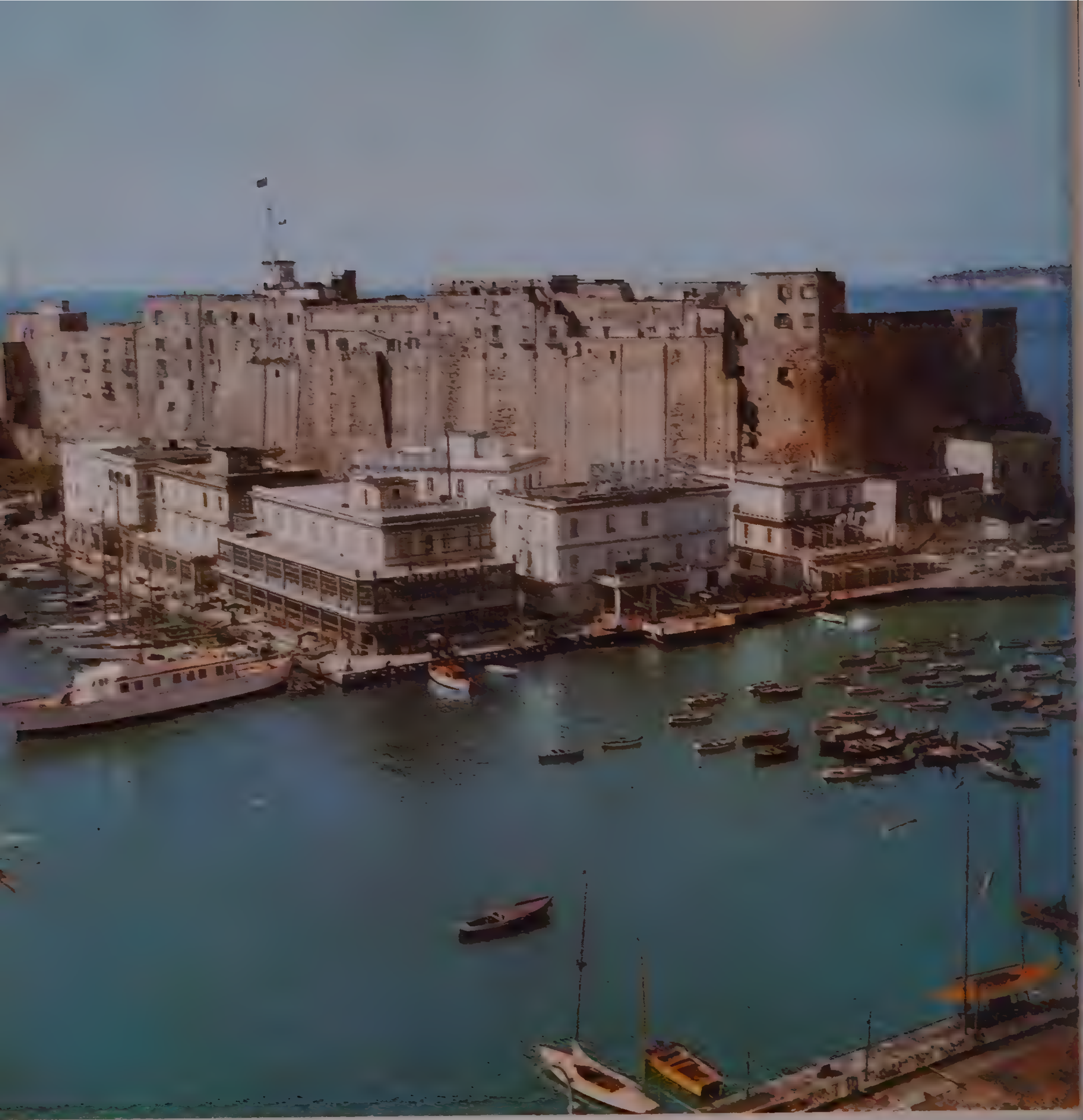




Bernard G. Silberstein, from Camera

ktachrome

Seen from the south, the Carthusian monastery of San Martino and the Castel Sant'Elmo (to the left) dominate Naples. The castle, built by Robert the Wise (1329–43), is now a military prison. The monastery, begun in 1325 and enlarged in 1580, is a museum



ernard G. Silberstein, from Camera Press *Ektachrome*

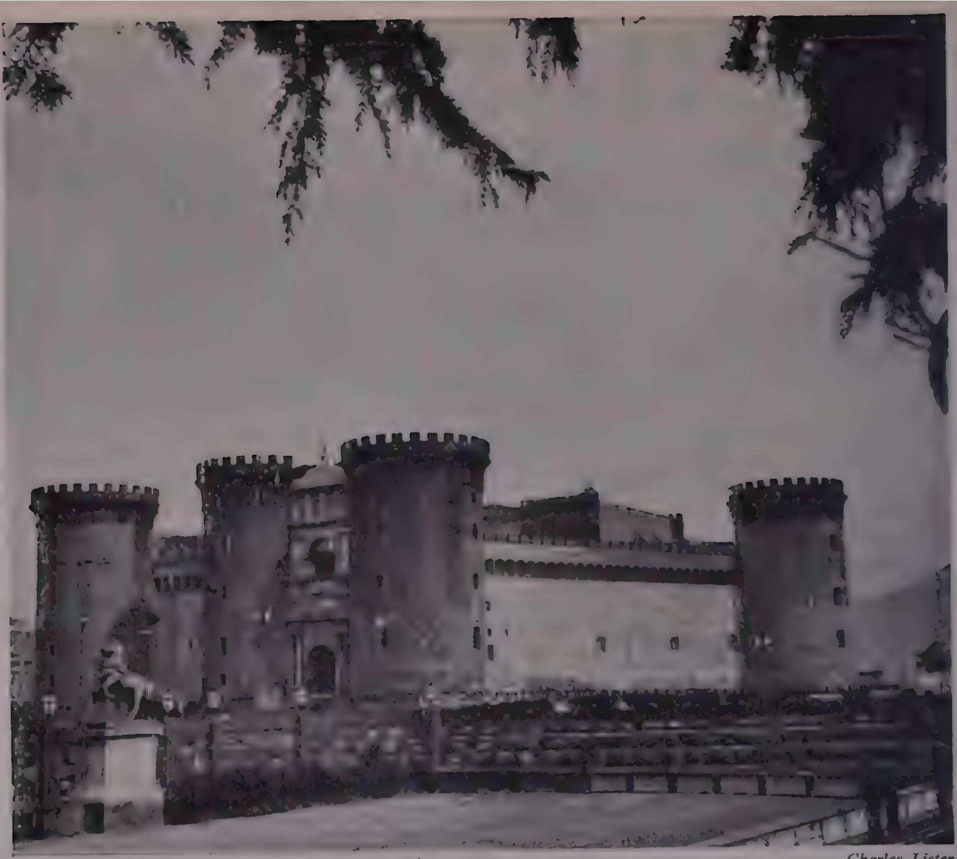
On the island the Romans called Megaris, off Santa Lucia, stands the Castel dell'Ovo. It was built on the site of an earlier fort by Frederick II (1194–1250), and was restored in the 16th century pulled down slums and abolished the hated privileges of the nobles and clergy. Naples began to expand and thrive for the first time in hundreds of years as squalor was cleared away, new quarters were opened, and the enormous Albergo dei Poveri was built for the poor and unemployed. At the same time Charles built the San Carlo opera house as a monument to the genius of such Neapolitans as Scarlatti and Pergolesi, while to house the Farnese treasures inherited from his mother he erected the Palace of Capodimonte high above the town to the east. Two more royal palaces followed: one south-east of Naples at Portici, now the Agrarian Institute; the other at Caserta, with twelve hundred rooms and eighteen hundred windows, rivalling Versailles.

Naples had never known such transformation as the process of cleansing, rebuilding and improvement went on; but this era of prosperity and enlightenment ended abruptly when Charles's son Ferdinand came to the throne in 1759. Nicknamed 'Nasone' on account of his enormous nose, this strange monarch so much preferred the company of Neapolitan riff-raff and *lazzaroni* to that of his courtiers that he allowed his wife Carolina to manage affairs of state while he went off to sell fish in the market place. As a result the common people of Naples adored him, but the new and free-thinking middle classes fell foul of his queen. She had no wish to see a counterpart of the French Revolution happening in Naples, so she ruthlessly revoked all Charles's liberal reforms. For the upper classes, however, Naples provided the most splendid royal court in Europe, on which the aristocracy of all nations converged. There were so many Englishmen there that one traveller recalls seeing 'a regular double wicket cricket match going on, Eton against the World; and the World was beaten in one innings'.

When Napoleon's army occupied the north of Italy Ferdinand decided to march against it; a disastrous move, as he was defeated in December 1798 and forced to flee to Sicily, leaving Naples to the victorious French. The Parthenopaean Republic, a farce which lasted only six months,

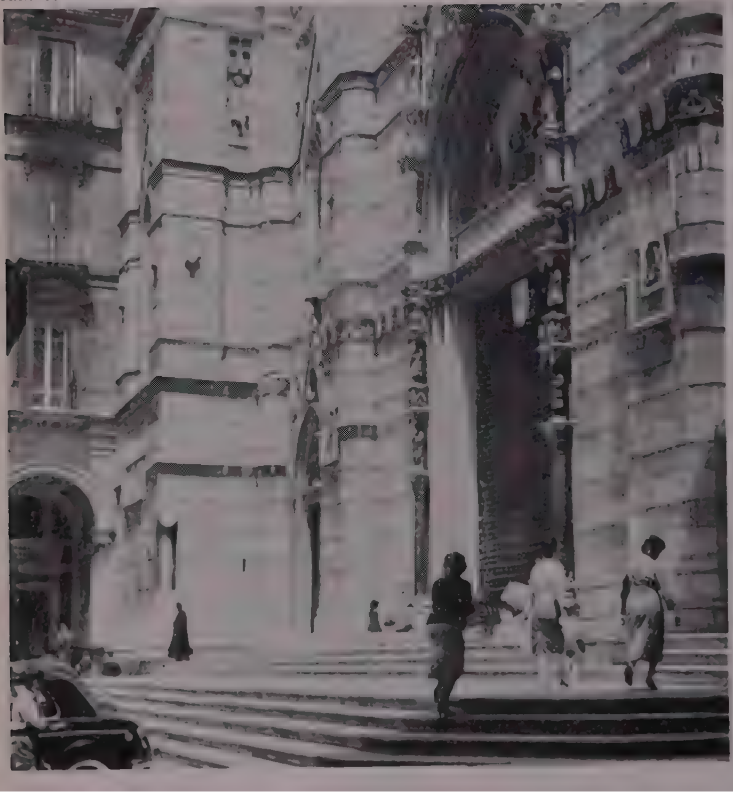
The baroque Immacolatella Fountain on the seafront at Santa Lucia. The statues are by Bernini

Paul Popper



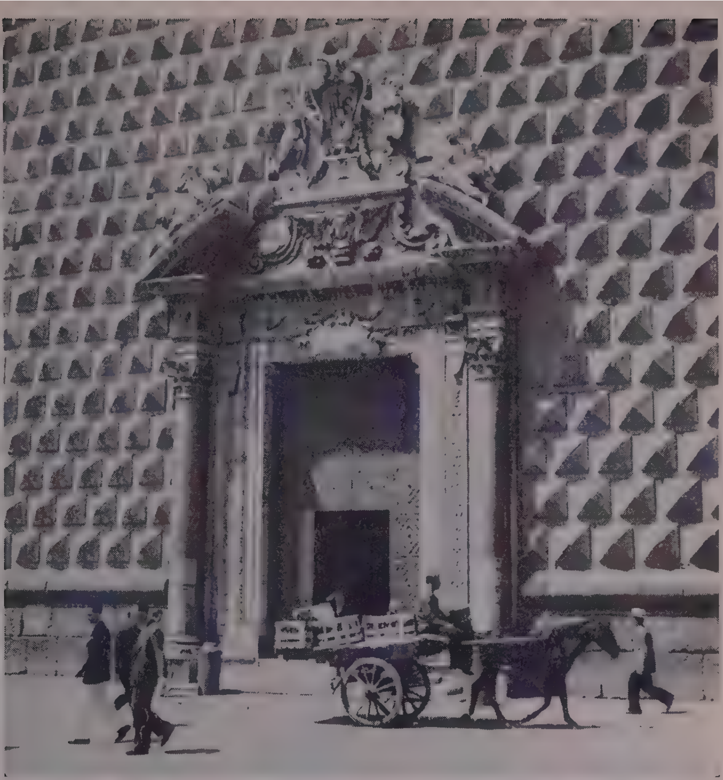
Charles Lister

Jack Scheerboom



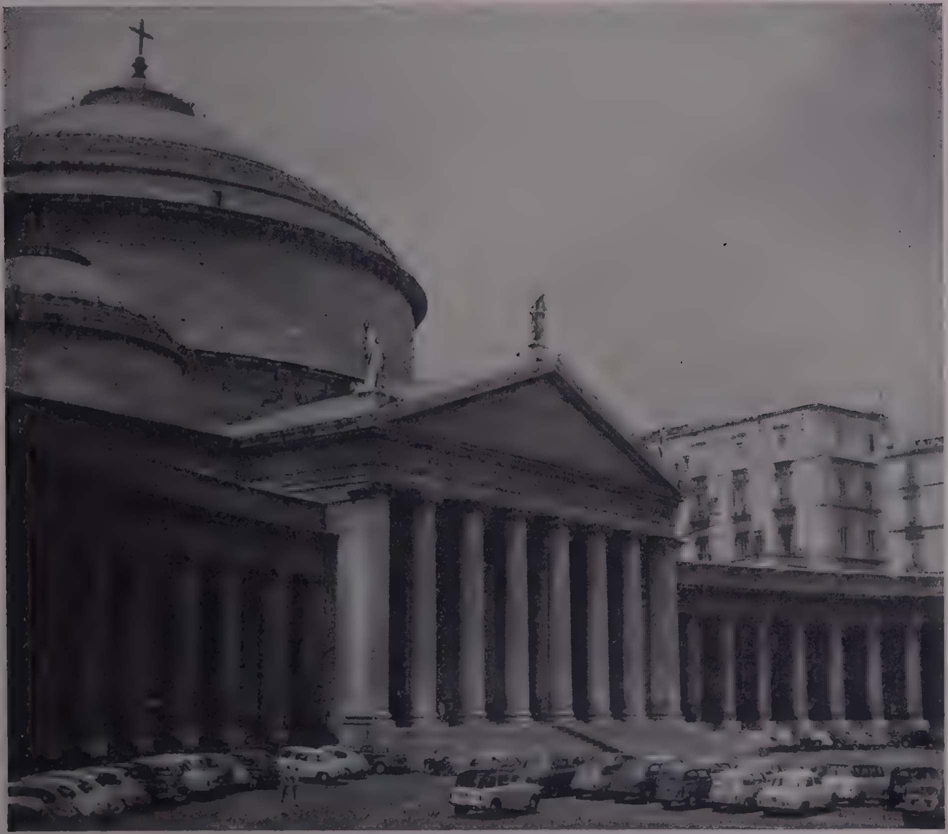
(*Above*) The history of the Castel Nuovo is the history of Naples itself. Built in 1280 by Charles I of Anjou, it was reconstructed by the Aragonese as a royal residence. Its triumphal arch (1460) commemorates Alfonso I's victories and entry into the city. (*Left*) The Cathedral of San Gennaro is another building with which the Angevins enriched Naples, though the front shown here was rebuilt in 1877

(*Right*) The curious 3-D façade of the Gesu Nuovo church was originally part of the Sanseverino Palace of 1470; the door was added in the 16th century. (*Below*) San Francesco da Paola, with its coldly classical lines inspired by the Pantheon at Rome, and its Doric colonnade, commemorates the return of Ferdinand I (Nasone), Bourbon king of Naples, from exile in Sicily in 1815



Paul Popper

Jack Scheerboom



ended when Cardinal Ruffo's infamous 'Sanfedisti' marched up from Calabria and massacred all revolutionary liberals who had welcomed the French. Ruffo was supported by Lord Nelson, who was by that time a devoted servant of the Bourbon Court where Emma Hamilton was a favourite of the queen.

The French soon retook Naples and, when Ferdinand finally returned in 1815, liberal feeling had become so strong that he was forced to rule as savagely as he knew how. All demands for a constitution were ignored and all trouble-makers were flung promptly into prison. The complete purge was carried on into the middle of the 19th century by his successors Francis and Ferdinand II, whose methods provoked England and France to withdraw their ministers and Gladstone to call the Bourbon regime 'the negation of God erected into a system of government'. Ferdinand II, however, did build the first railway in Italy, from Naples to Portici, and he established the first steel foundry there; but discontent continued to grow and when at last he granted a constitution in 1859 it was too late: Garibaldi was on the move. He entered Naples in a procession of triumph on September 7, 1860, bringing the reign of the Bourbons and the division of Italy to an end.

Thus a kingdom passed away and a great capital city became a mere provincial centre, the largest town in the smallest province in Italy. Naples suffered a sudden loss of prestige and received few benefits from the uniting of modern Italy. Industry that had been initiated by the Bourbons was uprooted and taken north; the port, once the busy gateway to a kingdom, became secondary to Genoa. Almost overnight Naples stood still, virtually abandoned and forgotten, while the north progressed in leaps and bounds. The city continues to give the same impression today: that history has passed her by for the last hundred years. The result is a mixture of dilapidated Bourbon splendour and mediaeval squalor, with a notable lack of modern development at the centre. One eyesore of a new building does rear up, and modern blocks of flats are edging in from the Vomero and the suburbs, but other innovations came only as a result of damage done during the war. The railway station, the central post office and part of the harbour are all new, but the rest is the Naples of the past, with narrow cobbled streets, no pavements, and the day's washing strung gaily between the tall buildings.

Here and there all over this town that has

The south side of the Royal Palace, with Castel Nuovo in the background. The Palace, twice restored, was built in 1600, and now contains government offices and the National Library

Charles Lister

Jack Scheerboom

Bathing is the eternal summer pastime of Neapolitan youth

grown up haphazardly throughout the centuries are dotted curious landmarks of history: a Roman wall, a Norman cloister, a Gothic arch, a baroque doorway. Plan and style are chaotic; there is no purity and no continuity; buildings have been thrown up according to the fashion of the age, random additions made to what already existed and bits tacked on to suit day-to-day needs. This remarkable conglomeration of history now sprawls crazily round the Bay with more haphazard additions cropping up periodically—a factory, a row of shops, a restaurant or, most likely of all, a fresh line of slum shacks on the outskirts.

The richness of their heritage means little to the present-day Neapolitans. Greece, Rome, France, Spain, the Bourbons and even World War II have long been forgotten; they have learned to disregard the past and distrust the future, and to adapt themselves wholeheartedly to the needs of the present. Repeated occupation and oppression have developed in them a remarkable quality of opportunism and resilience; far from being downtrodden they are permanently buoyant, and persecution has taught them a healthy contempt for authority and control. The dismissal of the mayor in 1958 for a municipal deficit involving some £10,000,000 was largely regarded by Neapolitans as a hilarious joke: he had made such a fool of the authorities in Rome. It was the fifteenth time the municipal body had been dissolved by the government in fifty years.

For the discriminating traveller the attractions of Naples go far beyond the stale tourist recipe of Capri, Positano, Pompeii and wavering mandolins, into a whole world of superstition, fable, history and romance. The chaos is the chaos of a city that has everything: flea-markets, black-markets, supermarkets and contraband cigarette markets; the most appalling slums in Europe and over fifty palaces; Padre Borelli collecting the abandoned children of the streets to live in the House of the Urchins, and the Camorra, the remnant of the powerful secret society, still controlling 50 per cent of Neapolitan business; unrivalled art treasures and the highest crime rate in Italy; scenic splendour and 100,000 unemployed. A Neapolitan historian has said that he does not know if there are more churches or brothels. While Olivetti has just built a new factory there to provide more work, a butcher in Via R. . . can still supply a passport or an American car within twenty-four hours. It is 'a microscopic territory overgrown with hoary traditions' where life is lived on the Greek pattern, where Spanish and French words continue in use, and clothes are largely 1943 government issue. In the historical, architectural and social bedlam in which they live, it is hardly surprising that the Neapolitans possess 'the vitality of the damned'.

Four-Day Wonder

by WILSON STEPHENS

Editor of THE FIELD

photographs by John Tarlton

NEXT month the Royal Show will be a four-day wonder at Cambridge. From a Tuesday till a Friday, the same days as in every other year, farmers will have made their pilgrimage, mostly from Britain but including some from the ends of the earth, and much will have happened. A small town will have been created. Perhaps 200,000 people will have walked its temporary streets. Another 12,000, equivalent to a modern Army division, will have taken part in the show as exhibitors, judges, stewards or officials. A superb, and spontaneous, piece of pageantry will have come and gone. For on the evening of the fourth day a great disintegration will take place, the same disintegration as in every other year, as pomp and circumstance give way to dismantlement in readiness for a repeat performance, 229 miles away and twelve months hence, at Newcastle upon Tyne.

People with tidy minds and a grasp of economics wonder at this great annual expenditure of effort. The turnstiles suck in a fortune which is forthwith dissipated in a major masterpiece of transportation and re-creation. Some grow peevish at the thought that an occasion so archaic should draw across the world not merely the loyal folk from the Commonwealth, but such hard-headed, progressive characters as Americans

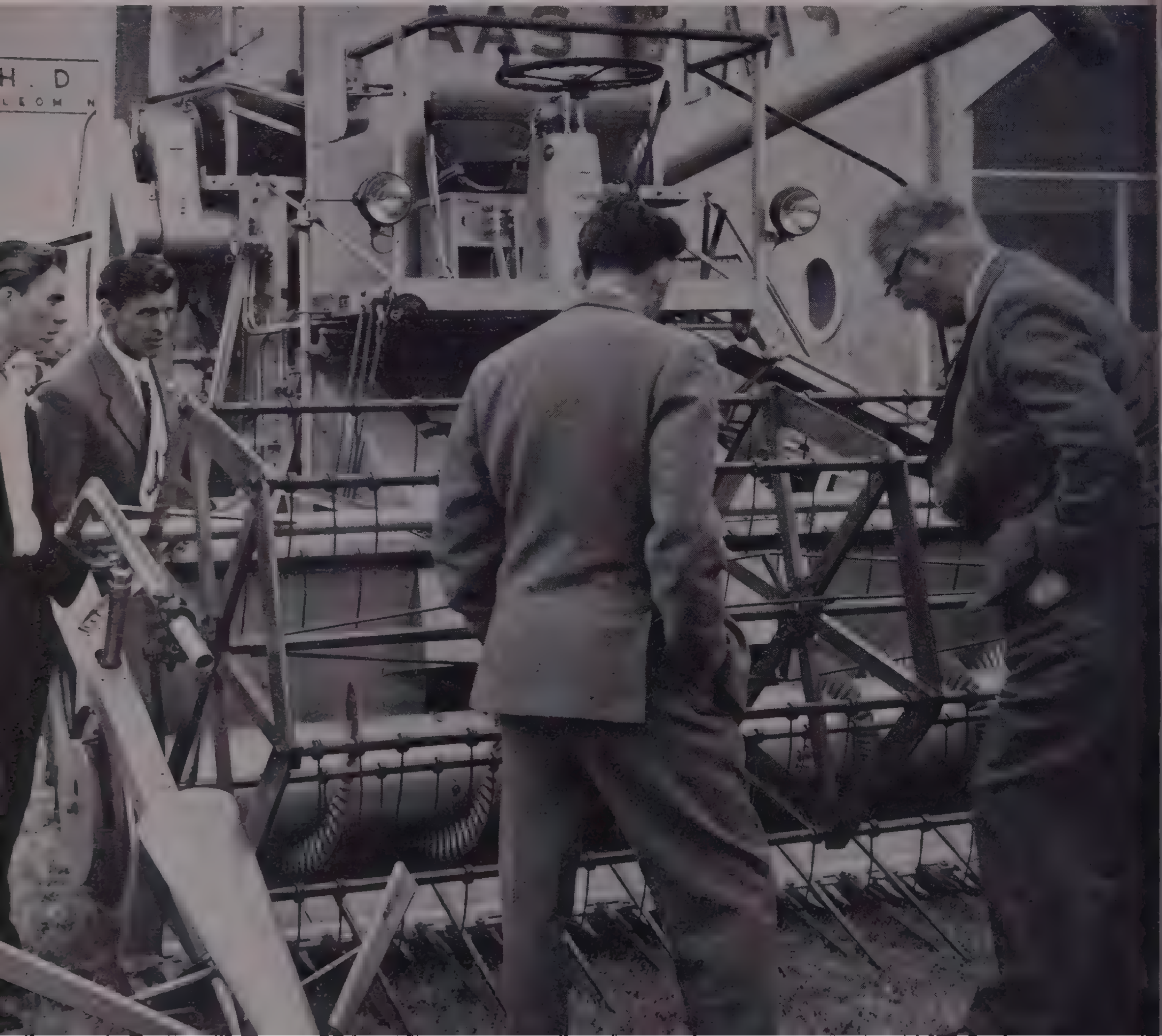
The construction of the stands, the making of roads or fences, laying water and drains—the thousand and one processes needed in preparation for the four days of the Royal Show all occupy many weeks of hard work. (*Right*) Laying a two-inch water main with the aid of a mole drainer. (*Below*) Some exhibits are plants growing and these have to be sown and tended long in advance. Here is one by the Ministry of Agriculture which demonstrates the old Norfolk four-course rotation of farm crops: roots, barley, clover and wheat

from their ranches and Russians from their collective farms. This is what the Royal Show does. It has done something of the sort for more than a century. No other agricultural exposition approaches in international influence this occasion which, obstinately refusing to vary a traditional form forged in the days of the Prince Consort, constitutes that recurrent paradox, a piece of true British reserve which achieves by apparent accident a brilliant spectacle.

But now, for the second time in history, change faces the Royal Show. Next year's move to Newcastle may be the last but one which it will make. Thereafter plans have been made for a permanent site at Stoneleigh Abbey, near Coventry. Whether, when the wanderer settles down in the respectable surroundings of a stately home, all the panache will be retained from its long years as a semi-circus, only the future can tell. What is certain is that the rolling stone has latterly gathered all too little moss, and its hitherto accommodating parent, the Royal Agricultural Society of England, has had to announce that the time has come to settle down. Before the change takes place, let us look at a national institution the like of which we shall not see again, the like of which no other nation boasts.

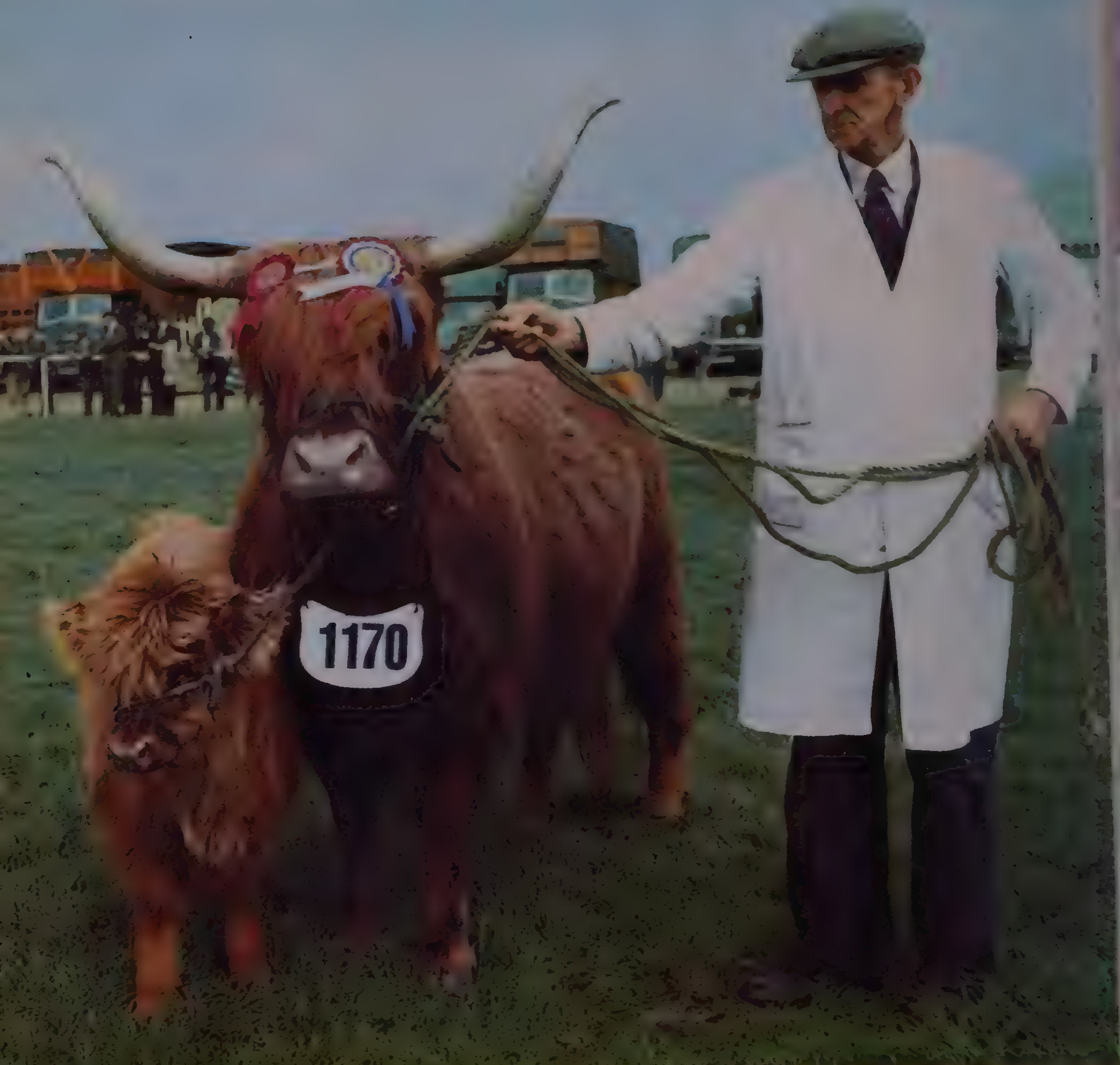
In part rehearsal for its static role, this year's show is at Cambridge for its second successive year. It will cover 170 acres, 15 more than last year when on a mere 155 acres things seemed a little cramped. In addition there are 125 acres of car parks. At 200 to the acre, this allows for 25,000 cars a day. Inside the temporary town 40,000 railway sleepers are being used to make

Exhibits come from all over the world: this giant combine harvester is manufactured in Germany

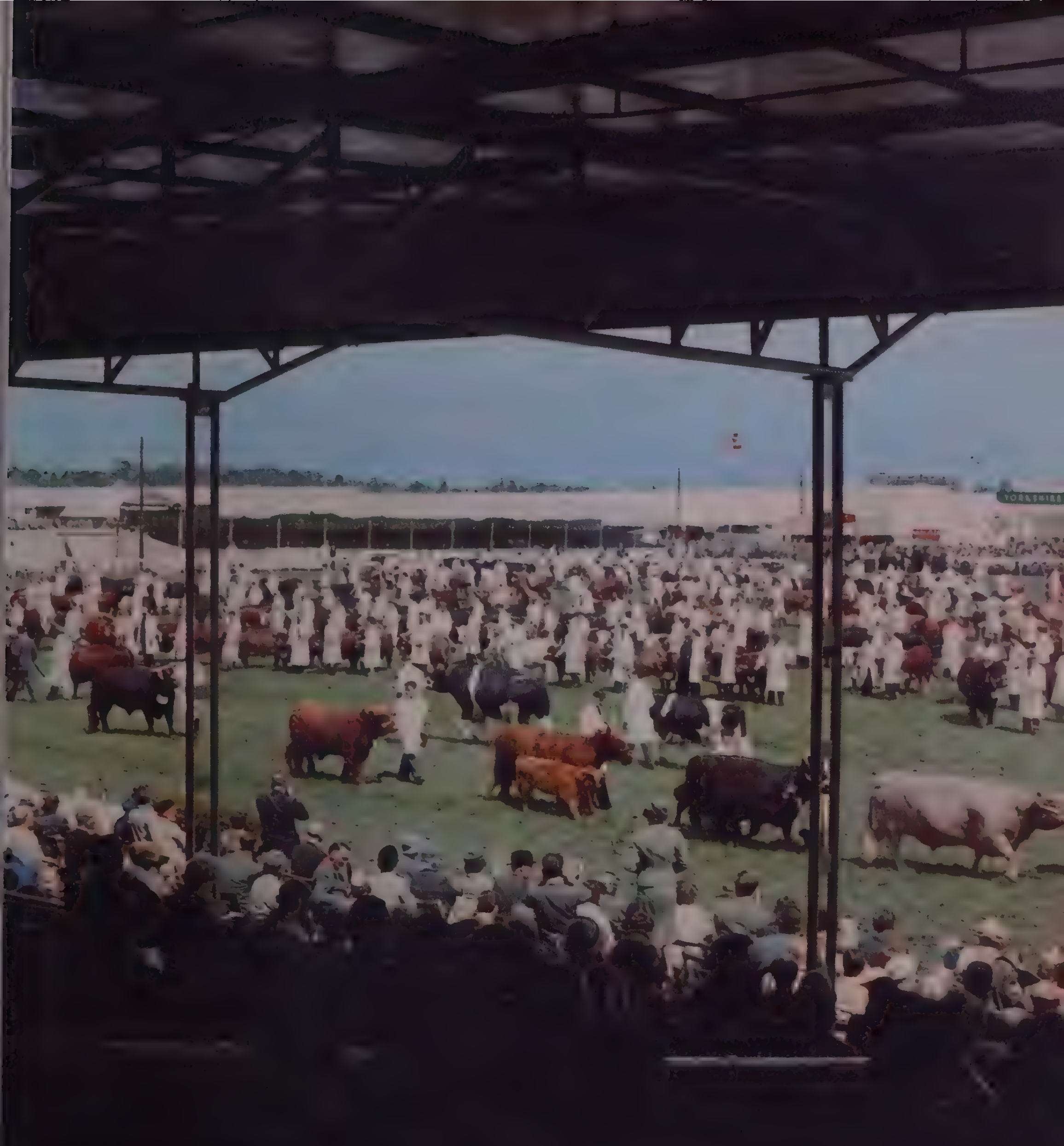


All Ektachromes by John Ta

Great Britain's agriculture is the most highly mechanized in the world and the Royal Show gives farmers a splendid chance to see and compare the latest developments in mechanical equipment



Highland cattle may seem almost a joke to the owners of smart Jersey herds in Sussex, but they are serious farming in Islay in the Inner Hebrides where Ghuaillean Og Ile 8th comes from, as well as at the Royal Show where she was champion cow in her breed in 1960



The Grand Ring at the Royal Show. The parades, whether of cattle, horses, hunt servants with their hounds, or any of the other attractions, draw big crowds during the four days of the show. This year, as in 1960, the Royal Show is being held just outside Cambridge

Badges of success: a Gloucester shepherd feeding his champion Oxford Down shearling ram after the first day of the Royal Show temporary roads, four electricity sub-stations serve eighteen miles of power lines, there are eleven miles of water piping (and twenty fire hydrants), workmen have screwed in 60,000 screws and knocked home twenty tons of nails, signwriters have painted nearly 50,000 letters on notices guiding visitors to wherever they wish to go, banks and post offices are being provided, a chaplain has been appointed. No sacred cows have had more done in their honour than the utilitarian farm stock, albeit the most expensive in the world, and it is four days in their life that animate the whole mammoth enterprise.

Nor, in those four days, will much be noted of the peace and subfusc tones of the villages and fields. The Royal Show is loud with vitality. The crowds flock down avenues flanked by bright-painted machinery (most of it working noisily), gay tents (some as big as a circus big-top), buildings of dazzling smartness, flags and bunting of every hue, pipe-clayed ropes, and long lines of sheds housing the cream of the nation's horses, cattle, sheep and pigs. Officially all this is known, with the understatement proper to all displays of magnificence in the United Kingdom, as 'the show-yard'.

In this yard, if such it be, may be encountered anybody from the Sovereign herself down to farm-hands whose blue serge suits recall ale and tobacco and are topped by cloth caps of striking pattern. Dukes, inventors, social climbers, cranks, aimless townsfolk lured by the word 'royal', camera-festooned Americans out to catch the British off their guard, dilute the massive inrush of farmers.

Like all sturdily independent communities, the farmers of our islands insist on their right to adhere to convention. All farmers therefore put on tweeds for the Royal Show, however hot the weather. Some wear bowler hats, to indicate that they are in a big enough way of business to go fox-hunting. Others favour soft hats to indicate that they are not employed men, nor from overseas.

The farmers from abroad form a picturesque minority. Men from the Middle West, in ten-gallon Stetsons, lean nonchalantly on the judging-ring rails to see the beef cattle. Much Spanish is spoken in the same neighbourhood, for the South Americans are also big buyers in this market. Australians seek out the dairy herds. African chiefs in gorgeous silks, and their settler neighbours conforming strictly to the home tradition, move hither and yon. Non-committal men in townish clothes from behind the Iron Curtain appraise sheep and pigs. All have been rubbing shoulders socially for weeks before the show.

The Royal Agricultural Society's motto is 'Practice with Science'. In interpreting it, little is left to chance. The legacy of Robert Bakewell, Jethro Tull, and Coke of Norfolk, each the inspiriter of one of the main streams of British farming practice which have flowed out into the larger world, is not being lost through failure to maintain a balance between what is practical and what is scientific. So nobody is forgetful of the need to market to the best advantage everything which is produced, including prestige. The Royal Show is partly a shop window, partly a shop, and the overseas visitors are the first to discover this. Through its contacts with government agencies, private firms and other societies, the Royal Agricultural Society is generally well aware of the approach of foreign visitors before ever they set foot in Britain. Thereafter the visitor is welcomed, entertained, his needs met, his interests catered

A champion Essex sow, back in the pig-lines after the judging

Hereford champion bull Vern Leopold being given a last-minute titivation in the Collecting Ring

for, introductions made, and steps taken to ensure that he sees not only the Royal Show, but what lies behind it.

So it is that the element of pageantry enters in, to serve a useful purpose. The bands, the foxhounds, the coaches and fours, and all that goes with them form the window display, a glamorous façade which brings the customers in. Once inside, big business is never allowed so to dominate the scene that there is nothing else left. The great machinery, foodstuffs and chemical firms, their individual turnover running into millions sterling each year, do relatively little actual trading at the Royal. But without the Royal many a deal would never materialize later. The same applies to livestock buyers. The seeds of thought which germinate into the purchase of a bull for £30,000 at a sale on a dark winter's day in Scotland were often sown in the lush surroundings of the Royal in the preceding July.

And lush indeed are those surroundings. It is well that those from other countries should see the background first, lest they conclude that the 'show-yard' reflects life as the yeoman lives it. For here, perhaps, Practice with Science is interpreted with a little licence. Last year's list of entries tells its story. They were 1499 cattle, 780 pigs, 681 sheep, and 1005 horses. Some horses, of course, are still used in British farming, but not many. Certainly not enough to support a proportionate entry close behind that of cattle and well ahead of sheep and pigs as the most significant livestock in our countryside. It is possible to argue, of course, that a cob is operationally necessary to enable a farmer efficiently to overcome the limitations of mechanical transport, that a hack alone can enable his lady to discharge the duties of the distaff side with proper mobility, and that only by encouraging the breeding of suitable hunters can the practice and science of agriculture be safeguarded against the inroads of foxes; possible, but pointless.

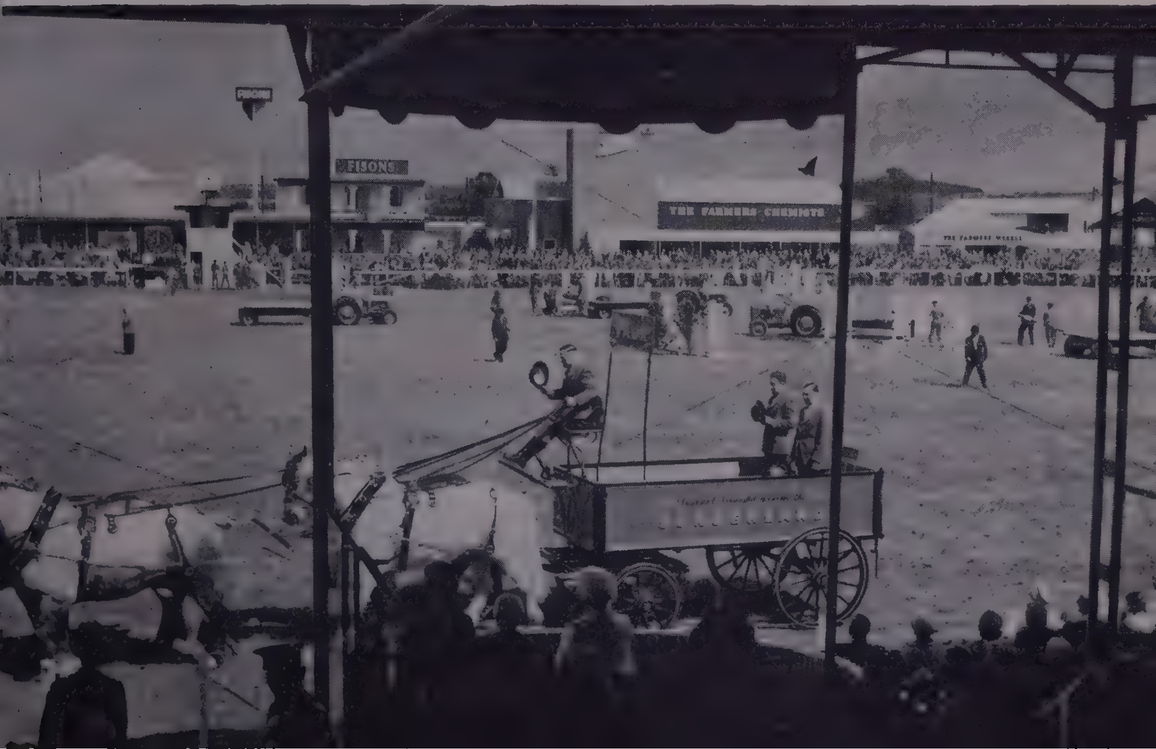
The fact remains that, whatever the hard realities of food production, farming is a way of life in which other things have their place, and the Royal Show is the unsponsored, natural, self-engendered exposition of life in the countryside. If it is not a mirror, it certainly is a vignette; slightly idealized, perhaps a little over-coloured, but remaining true in essence and hence retaining its grip. If the occasion looks in places a trifle starchy, the starch is doing a good job. It does everybody good, once in a while, to turn out looking their best, and to see their neighbours doing the same.

The county magnates who go into orbit between the members and the royal pavilions are by no means alone in this. The herdsmen themselves, many of whom spend the summer touring the county shows in attendance on bulls or stallions or sheep or pigs, present a very particular spectacle at the Royal. The word herdsman, which in this context is the official one, may arouse the bucolic vision of some Churdles Ash, shirt-sleeved, be-gaitered, and chewing a straw. This would be far from the truth. Herdsmen at the Royal look like scientists of some eminence dressed for the laboratory. Responsible of bearing, as befits those in control of large and sometimes indirigible animals with wills of their own, they wear white coats of a smartness unexcelled elsewhere. The part they play is, at all times, in the centre of the stage. Their lives reach a climax at the Royal. It is the one occasion when, barring accidents, all the top exponents of the fine art of exhibiting animals may expect to meet. From Argyll to Cornwall, no herdsman of consequence fails to make this particular journey.

After a year on circuit, as it were, the great occasion unites them all. By day the mask of formality is dutifully worn. Like barristers, whose duty is likewise to impress judges, herdsmen affect a dignified bearing and are grave of speech. But, as also with barristers, at evening a different atmosphere prevails. The Royal Show, like any other small town with appearances to keep up, also knows how and when to invoke the spirit of *fiesta*. So, when the great have departed to their hotels and the sleeper-built roads are empty, the air grows jocund and time-honoured formalities take place.

Formerly the tug of war was the currency of unofficial rivalry. Betting was not unknown. Great was the jubilation, for instance, when the Large Black Pigs, against what might be thought the run of form, pulled the Shire Horses off their feet. But then fashions changed, as fashions do, and football replaced the tug of war. Now, perhaps because of the march of time, darts have replaced football underneath the awnings when

A team of percherons passing the Royal Box in the Grand Ring. Many horses are still shown



(*Opposite*, *above* and *right*) Off-duty at the Royal Show, tradition demands a set ritual of suppers, after-supper speeches, songs or merely a cup of tea and a natter

The Young Farmers take an active part in the Royal Show. Members judging British Friesians

the crowds are gone. One evening is given up to the most eagerly awaited of all the Royal's private functions, the herdsmen's supper. Notable performers in song and speech still exist in an England which some think has been struck dumb by television.

Every Royal Show unfolds itself without varying in certain details. This fidelity to form is an answer to those who believe that times are different nowadays. On the contrary, in the smallest particulars they remain changeless at the Royal. Always, just inside the main entrance, stands an affable man who sells pocket mackintoshes. In the most brilliant sunshine he has for years remained both sanguine and urbane, biding his time in the knowledge that our climate is on his side. The feminine element is his special concern. Given half a chance by a cheerful weather forecaster, the farmers' wives of Britain make a brave show in summer frocks, as if to prove that it is not necessary to go to Ascot to see healthy womanhood graciously arrayed. The briefest of showers is then enough to make every passing husband reach for his wallet.

At the stand labelled Honey, and Bee Appliances, there has gathered throughout living memory a little knot of clergymen and generals. Always, when a bee-keeper joins the swarm in the great beyond, it seems that another clergyman or general is ready to take his place. Why the cloth and the sword should become so preoccupied with the hive has never been explained, unless it be that the sight of an orderly congregation of bees, well regimented, has an appeal for both.

This England never did, nor never shall, lack ladies of the requisite presence to form a crew on the Women's Institutes stand. Just how the Institutes have transformed village life in Britain, only the villagers know. So long as *Jerusalem* is sung, and competitions are judged and won for such worthy exercises as the making of ninepenny meat pies, the hand that rocks the cradle will doubtless aid the Royal Show, which could not reflect England without it.

Amid everything that is new on the machinery stands, amid everything that is old in the immemorial features great and small which mark the four-day township, is an unspoken recognition that the show is royal in something more than name. In fact, at the Royal Show, royalty is seldom far away. Six sovereigns have given the Royal Agricultural Society their patronage. Other members of the Sovereign's family have also long visited the show for no other reason than an interest in some aspect of farming. Further, the Royal is one of the occasions at which convention ordains that the presence of royalty is not to be regarded as anything but natural. This has put a momentary strain upon the *savoir-faire* of some critics who, turning to direct a comment to a ringside neighbour, have found themselves about to address a Royal duke in homely terms.

To its atmosphere of country good-fellowship, the Royal Show has hitherto been able to add an ever-recurring novelty. It has gone, literally, to meet its public by changing its venue year by year. To the folk of the corner of England to which it went, the Royal Show of that year was *our* Royal. This meant much. We English are wrongly described as insular. Our horizons have not yet broadened to the extent that we are accustomed instinctively to think of ourselves, if we are bred in a rustic mould, as English. We think of our counties first, and only afterwards of our country. England is the portmanteau in which, with other goods, each of our precious shires is packed. Even in war the sons of our soil join the Gloucesters or the Dorsets, or whatever the county regiment may be, rather than the Army. A private in the Buffs regards himself as a lost soul if a cross-posting takes him even temporarily to the Lancashire Fusiliers, in which unit men speak a different tongue, and if they do not worship different gods at least they follow different football teams.

Even younger but even more active are the Boy Scouts, prepared to turn a hand to any useful job

The show is royal indeed: its royal pavilion has sheltered every British monarch since 1880

Across these local prejudices, none the less real by being so familiar that we accept them as unremarkable, the Royal Show must now cut. Its future depends on its power to call across the county boundaries, which are not only administrative definitions but ramparts to the thinking of those planning a pleasure trip or the spending of money, and to draw all England around it at Stoneleigh, in Shakespeare's Forest of Arden. Instead of the show going to the people, the people must henceforth go to the show to a greater extent than before. One more journey and the new Royal Show will begin to take shape.

Eighteen months ago, that journey from Cambridge to Newcastle was planned. On the very evening of the last day at Cambridge the first moves will be made to assemble, ready for loading onto trains, the 1700 tons of collapsible buildings which are the core of the Royal Show. All the bright pavilions, rivalling in stateliness the pleasure domes of Xanadu, collapse according to plan, and rear themselves up again elsewhere. The royal pavilion itself has taken shape up and down the country for eighty-one years since it was first built to shelter Queen Victoria, then Widow of Windsor, and Edward Prince of Wales. Soon, it seems, it must take root.

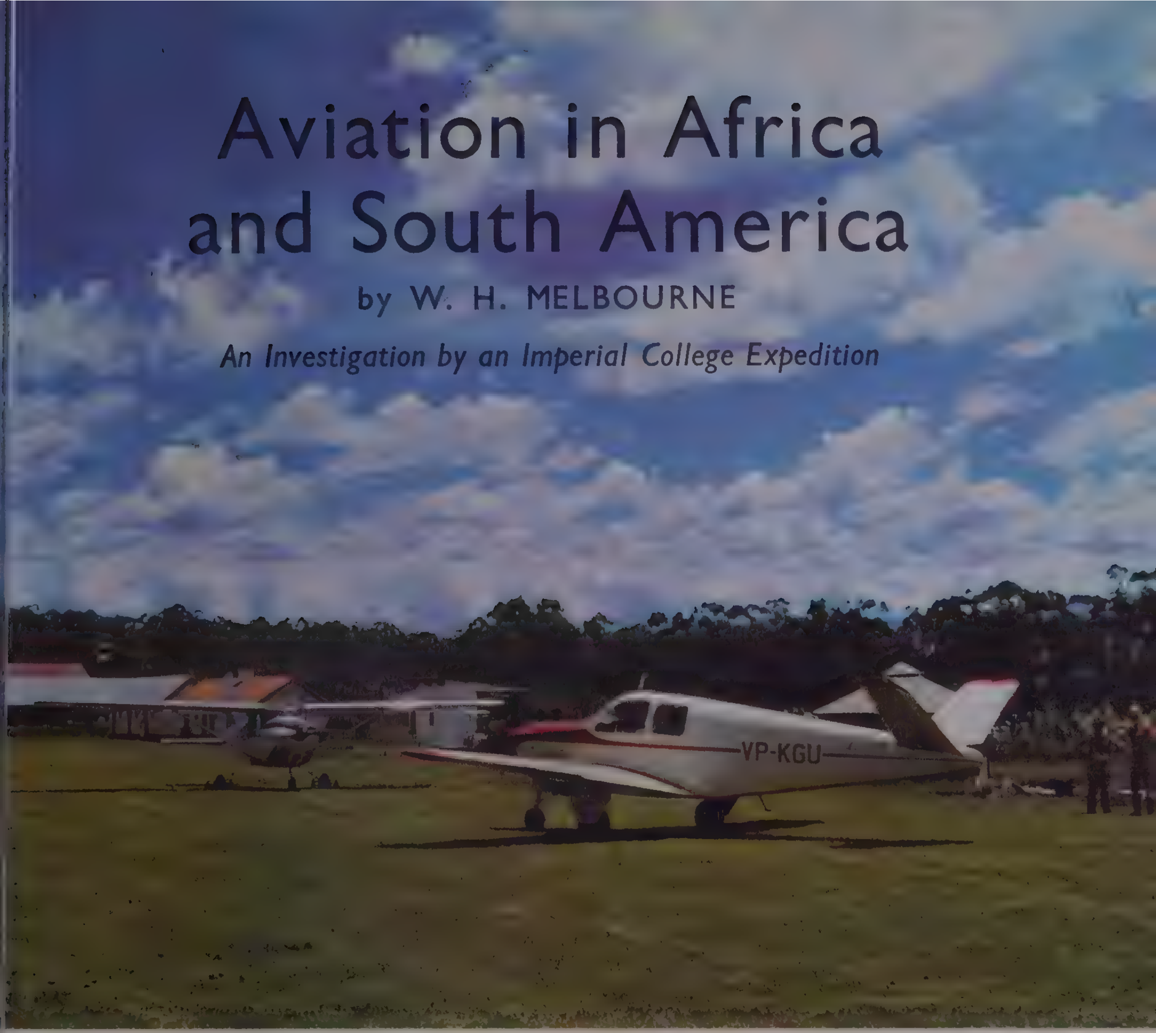
When it does so, the rest of the show may change a little in character. The key-note of the travelling Royal has, of course, been its element of 'here today and gone tomorrow'. It has arrived as a distinguished visitor, bequeathed its message, and taken its leave. Rooted to the spot in the English Midlands the Royal must begin to preach a gospel and draw its congregation. This gospel will certainly centre round Practice with Science. Probably it will take the form of an increase in demonstration and a decrease in competition.

Man and beast alike are parasites on the world of plants. Machines and beasts are not the fundamentals of agriculture. The roots, stems and leaves of growing crops are the foundation of it all, the essential sustenance which other forms of life are merely the means of using, and of which implements are the means of nurturing or gathering. When the Royal Show stays put it will be possible to exhibit fully for the first time the farm plants without which nothing else has future or meaning. Perhaps the world's greatest farm show stands on the threshold of a new lease of life.

Aviation in Africa and South America

by W. H. MELBOURNE

An Investigation by an Imperial College Expedition



All Kodachromes by the au

The airfield at Kitale in the Kenya Highlands. In the foreground is the four-seat Beechcraft Bonanza used by Dennis Pharazyn's one-man charter company for air-taxi work. The privately owned Cessna 182 parked behind is typical of the aircraft popular amongst European settlers

THE scream of aircraft jet-engines over the ship ferrying us across to Tangier diverted our attention from the fast receding shape of the Gibraltar Rock and reminded us of our journey and work ahead. I and my companions Dave Hyde and Ian Gartshore, all aeronautical engineers, had set out from London in a Land-Rover to drive through Africa, then, after crossing the Atlantic to Brazil, to continue through South America. Our object was to find out some of the problems facing the operators of aircraft, particularly of light aircraft, in these two continents.

The North African deserts still form a severe obstacle for aircraft, and except for military aircraft and long-distance international airliners we saw little activity until we reached that territory loosely defined as Africa south of the Sahara. Our journey took us across the flat, featureless Tanezrouft Desert, along the Niger River and into the densely populated country of Nigeria.

The indigenous Nigerians are inveterate travellers, yet the age of air travel has made little impression on them. This is because they usually like to carry a vast quantity of luggage, are rarely in a hurry, and are relatively poor. Instead they cramp themselves and their belongings into specially modified trucks known as 'Mammy Wagons'. As a result the response to air travel has been disappointing to W.A.A.C. (Nigerian Airways), who early in 1960 were forced to withdraw their eight small four-engined Heron aircraft and now operate much reduced services using only seven twin-engined, twenty-eight-seat Douglas DC3s. Two new projects being investigated in Nigeria are the air-freighting of beef from a new abattoir at Maiduguri (in the disease-free north-east) to Lagos and Accra, and the possible use of hovercraft for collecting produce such as bananas along the Niger and Benue Rivers.

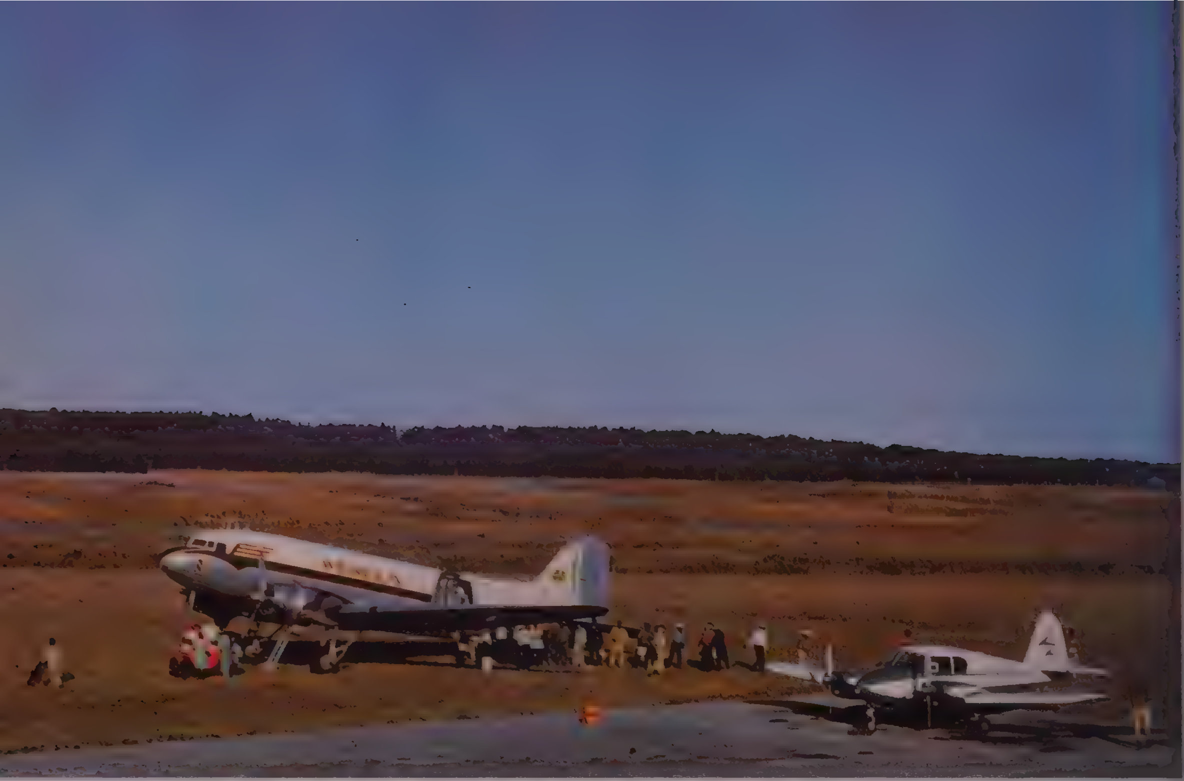
Since their independence from France the new states between Nigeria and the River Congo (Cameroon, Central Africa, Gabon and Congo) have done little or no work on their roads; bridges are down and some sections are barely passable. In 1960 there were very few aircraft in this area except those of the French and Belgian airlines, and they were almost exclusively used by the few remaining Europeans. In the Belgian Congo itself, before independence, there were thirty-one aircraft registered with aero clubs and about twenty owned privately, but I do not know what is left now.

We managed to avoid the riots in Stanleyville by keeping away from the worst areas of noise, and we were only stopped once by a Congolese mob with a tree across the road; even they became more or less friendly when they discovered that we were British not Belgians. With a feeling of relief we left the chaos in the Congo and crossed the Ruwenzori Mountains. It was in East and Central Africa and in the Union that we found the most interesting aerial activity in the continent.

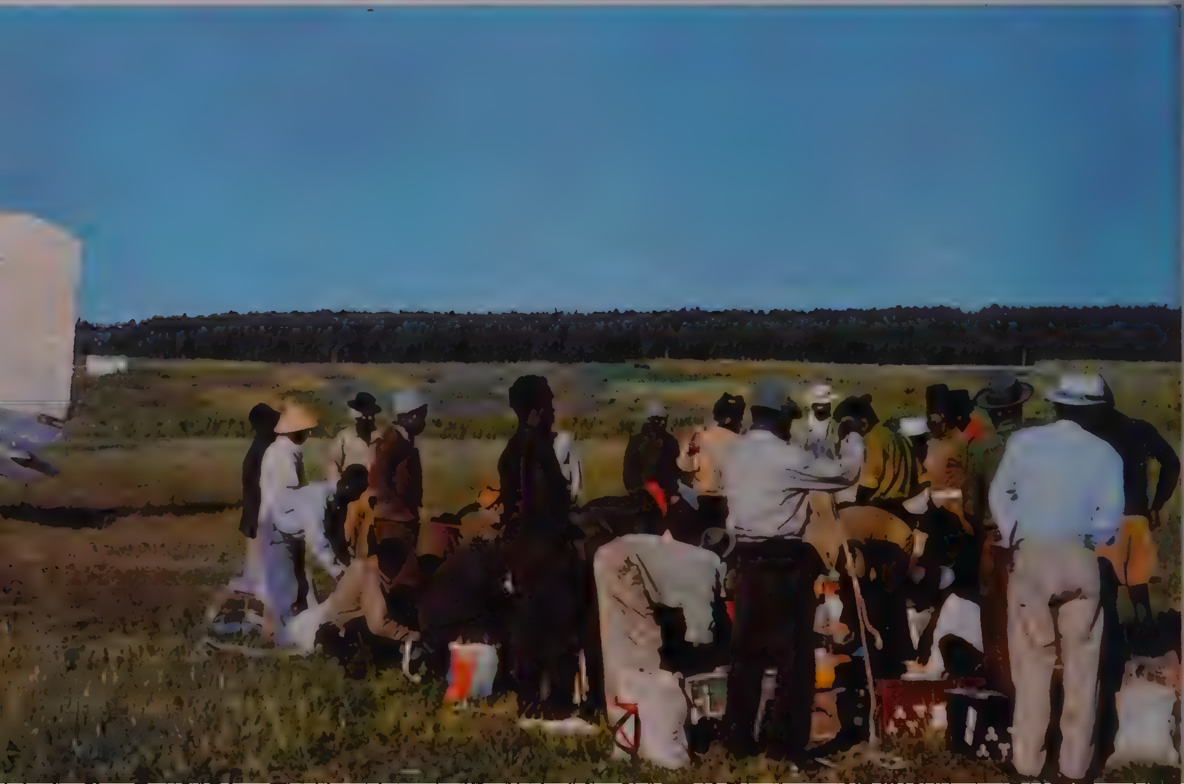
In Kenya, Wing-Commander Frankel described to us the operations of the eight single-engined Cessnas under his command in the Kenya Police Air Wing, which vary from free-

Between Lake Chad and the Congo there are dozens of smaller rivers which can only be crossed by ferries. If these were to stop operating because of any political disturbances, surface transport would come to a halt and only aircraft would be of use in this little-developed area

While their ship is in port on the east coast of Africa, tourists can make a quick trip by air into the interior to the Wankie Game Reserve or the Victoria Falls. Some charter companies also run special flights to give visitors an air view of big game in the bush



(*Above*) The Witwatersrand Native Labour Association runs cheap flights for African labour. At Mbeya, in Tanganyika, a DC3 unloads men who have been working in the Johannesburg mines. (*Below*) A nominal customs check of their newly acquired possessions is held on the runway



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(*Above*) Desert country, such as this in the Sahara near Reggan, is a barrier to light aircraft. **(*Below*)** Children on the so-called main road near Bambari in the Central African Republic, north of the Congo; how aviation will affect the new West African nations is an open question

The tranquillity of this scene in Rio de Janeiro is shattered every few minutes by the noise of aircraft operating from the busy airport, reclaimed from the sea close to the city centre

dropping supplies to rescue teams on Mount Kenya at 16,000 feet, to spotting ivory-poachers on the game reserves and acting as anti-smuggling patrols along the coast. One of the most interesting uses of aircraft in Kenya is the Desert Locust Survey, which has it headquarters in Nairobi. In July, when locusts enter Africa from Arabia, officers of the Survey, with three powerful single-engined Canadian Beaver aircraft, spray the swarms in Ethiopia and Somalia, before following them into East Africa.

Typical of the small charter, or air-taxi, companies is the one-man concern of ex-R.A.F. pilot Dennis Pharazyn. He is based at Kitale, a centre for European settlers in the Kenya Highlands, where he has a single-engined, four-seat aeroplane which he makes available for general charter, although in fact he uses it mostly for flying the 200 miles between Kitale and Nairobi.

In Entebbe, the capital of Uganda, on the north shore of Lake Victoria, we found three De Havilland Rapide aircraft. These amazing old wood-and-fabric biplanes still fly a scheduled passenger service around Lake Victoria.

A spectacular use of slow-flying aircraft in this part of Africa is to provide adventurous tourists with a close-up view of big game from the air. There is a company at the Victoria Falls which uses Rapides for this purpose: after giving the tourists an unforgettable sight of the Falls—which are seen at their best from above—they then fly almost at ground level alongside herds of elephants, giraffes and other animals of the African bush. And all for only £5 a head.

Several small helicopters have been introduced into Rhodesia in the last few years, mainly to transport surveyors and geologists in the Copperbelt area in the north. One new job for helicopters is to patrol the power lines from the hydro-electric plant at the Kariba Dam.

In contrast to the lack of interest taken by Nigerians in the possibilities of air travel, the success of the Central African Airways 'Skybus' is outstanding. Started in January 1960, this third-class service, operating forty-seat DC3s between Blantyre and Salisbury, conveniently enables Nyasaland labour to reach the industrial areas of Southern Rhodesia. The single fare on the 300-mile flight is £4 10s. compared with over £12 in the turbo-prop Viscount. The aircraft are nearly always full, mostly with Africans and Asiatics, as Europeans are not encouraged. The 'Skybus Booking Van' which tours the African townships helps to keep the fare down: a seat can only be booked by a non-returnable full cash payment to the van conductor.

Wenela, the Witwatersrand Native Labour Association, uses eight forty-seat DC3s and two ninety-eight-seat DC4s to carry African labour from Rhodesia, Nyasaland and Tanganyika to Francistown in Bechuanaland; from here the men travel by rail to Johannesburg to work in the mines. About 100,000 Africans are carried each year and they are only allowed to work for eighteen months (for about 15s. a week with keep and the fare included); then they are carried back to their homes again by Wenela. Although this may seem to be an extremely low wage, the system does appear to be beneficial to the men, who compete strongly for the work, as it is one of the few ways for the bush native to obtain relative wealth and 'to see the world', as one of them explained to us when we watched this operation at Mbeya in southern Tanganyika.

In the Union of South Africa about 85 per cent of the 640 aircraft registered are small single-engined aircraft. This gives some idea of the extent of communication and club flying over a large country even when the roads are good. Some of these small aircraft are used for agricultural spraying, which is becoming a highly developed process in South Africa, with fierce competition keeping prices low. Cotton is sprayed in Basutoland, wheat in the Western and Cape Provinces, maize in the High Veldt and wattle and sugar in Natal.

Two geographical features common to much of Africa, which pose severe problems to aviation, are the high airfield altitudes and the high air temperatures. The engine performance and

Corumba on the Paraguay River in western Brazil. This country is typical of a great part of South America, virtually untouched by surface transport apart from ships on the Amazon River

The road that winds its way over the Andes from Mendoza in the Argentine to Los Andes in Chile is one of very few crossing the mountains. It is closed for six months each winter, even though cars can be put on a train to avoid the worst of the journey

(*Above*) In 1960 the Comet jet was the only aircraft which could regularly take off from Santiago airport and cross the Andes by the shortest route. (*Right*) Another type of terrain in South America where air travel seems the real answer is the Atacama Desert

La Paz airport is so high up that passengers coming straight from sea level are sometimes badly affected by the altitude and have to be given oxygen. The loads that planes can carry at this height are limited

lifting power of the wings are reduced at high altitudes and temperatures; to such an extent that it is frequently not possible to carry full loads. This is a particular problem in East Africa, where the sides of the Rift Valley rise to over 10,000 feet and are under an equatorial sun all the year; while much of Rhodesia and the South African High Veldt is up to 5000 feet high.

Trying to forecast the effect of aviation on future life in Africa is like forecasting political events, and the two go hand in hand, as flying is at present almost exclusively the province of the European. We did not meet an African pilot anywhere in our travels, although several are now being trained for Nigeria and Ghana where the new governments have up till now been entirely dependent on European pilots.

From South Africa we crossed to South America to see how aircraft operate in a continent made up of jungles, swamps and vast plains in the east, with a narrow coastal strip in the west cut off by a range of mountains stretching for 4400 miles at an average height of 13,000 feet. South America, with these natural barriers combined with totally inadequate surface communications, presented us with a scale of aerial activity that made the African efforts look minute.

The largest republic, Brazil, had about 3100 aircraft registered in 1960, of which 2800 were small aircraft used by private owners, aero clubs and charter companies. Even more impressive is the work done by the 300 larger aircraft, carrying freight and passengers internally in Brazil or to near neighbours. The stretch of 300-odd miles between Rio de Janeiro and São Paulo has one of the highest air-traffic densities in the world, and at Rio airport, which has been reclaimed from the sea just twenty minutes' walk from the city centre, you catch an aeroplane as you would catch a bus anywhere else. The aircraft are American transports, predominantly DC3s, Dakotas, Curtis Commandos and Convairs, all of which are twin-engined machines capable of carrying respectively from thirty to fifty passengers and their baggage. It was these aircraft that carried all the material into the roadless centre of the country to start building the new capital city of Brasilia. Further up country, we found five old Catalina flying-boats giving good service along the rivers of the Amazon basin.

The ranch owners of the Argentine and Uruguay make good use of light aircraft, as is shown by the words 'airstrip available' which often appear in advertisements for cattle sales. Mr Harriet, the greatest rancher of all, operates twenty-two single-engined aircraft over his 2,000,000 acres of property, because they are cheaper and more efficient than surface transport; also, he explained, 'one man can look after a far greater area from a plane than from horseback'.

Aerial photography and geophysical survey work, being done in the Argentine for the oil exploration companies, is another way in which flying is helping to develop South America.

It was mid-winter when we drove westwards across the Argentine pastures from Buenos Aires to Mendoza, in the eastern foothills of the Andes. We learnt here what a formidable barrier these mountains are to cars and lorries: for up to six months of the year snow lies deep in the passes and closes the roads. A forty-minute flight would have put us in Santiago, Chile, but instead we had to wait many days before getting our Land-Rover onto a train. The cog railway line is kept clear with snow ploughs as it creeps up the valley past Aconcagua, which at over 23,000 feet is the highest mountain in the Americas; and then just as the last stretch seems impossible the line goes into a tunnel, and we next saw daylight looking out over Chile and the Pacific Ocean. Even with the tunnel this railway is frequently closed for weeks because of avalanches.

Chile is a 2800-mile ribbon of land lying between the Andes and the Pacific Ocean, and efficient transport has always been a difficulty. For many years coastal steamers were the most usual way of getting from one part of the country to another; but even as long ago as the thirties air travel was becoming increasingly popular between the main centres. Now, despite considerable poverty both of land and people in many parts of the country, there are fifty-five aero clubs using 260 small aircraft, all substantially subsidized by the government. Here again American transport aircraft are used extensively and their possibilities have been even more appreciated since the recent disastrous earthquakes.

Our four-day journey by Land-Rover from Santiago to Arica, the last town in the north of Chile, showed us plenty of reasons why air transport is to be preferred. Parts of the Atacama Desert are even more uncomfortable to cross than the Sahara. It was with no sorrow that we left this hot coastline and climbed up into the cool mountains to Lake Titicaca and La Paz.

In Bolivia the vast Altiplano, at about 12,500 feet, contrasts with the eastern semi-tropical lowland. The country is relatively backward in aviation, presumably because of its precarious financial state. Most of the airline-operated machines are obsolete ex-U.S.A.F. aircraft, and even converted four-engine bombers of the Liberator and Flying Fortress type are used. The air-freighting of beef from the Rio Beni area in the jungles of northern Bolivia to La Paz on the Altiplano has proved a profitable venture for many years. La Paz airport has the distinction of being the highest commercial airport in the world, but its altitude—13,358 feet—means that it is not really suitable for light aircraft; a few are flown in the lowlands, to the east of the eastern cordillera of the Andes, where aircraft have been used for over twenty years, directly supplanting the previous means of transport which, beyond the railheads, was normally mule and canoe. Even before the war, planes had reduced to a matter of an hour or two journeys in this jungle country that had previously taken a month.

Our route took us northwards through the mountains to Cuzco, the seat of the old Inca empire, and then down to the bitumen road which runs the full length of Peru along the coast. While Lima itself is prosperous most Peruvians are very poor. Consequently Peru has relatively few light aircraft, though cotton spraying is a regular business in the north. The shining light in Peruvian aviation is the old-established Faucett Company, which is noted for its service and reliability and has the rare distinction of being an airline which operates aircraft of its own manufacture. Thirty Faucett-Stinson seven-passenger aircraft were built around 1945 and did invaluable service, particularly working from primitive strips in the jungle and Andean mountains; four are still flying on scheduled passenger routes.

Ecuador, like Peru, has distinctive coastal, Andean and forested regions. The light aircraft activity is chiefly concentrated along the coastal strips (as are most of Ecuador's resources) and some fifty aircraft are used for spraying the banana plantations.

In general the work of missionaries throughout Africa and South America is helped by light aeroplanes. An interesting example in Ecuador is the

The mountains of Apolobamba in northern Bolivia are representative of this part of the Andean barrier

Aerial spraying of crops in Peru, Ecuador and Colombia has proved very successful. The most popular aircraft for this work are the Piper Super Cub on the right, and the new Piper Pawnee

Missionary Aviation Fellowship, which serves Protestant missions in the jungle on the eastern side of the Andes. But aircraft have by no means eliminated all the hazards of missionary work, as a few years ago a pilot of the M.A.F. and three missionaries were killed and the aircraft destroyed by Indians in this area.

We found that the mountain roads through Ecuador and southern Colombia, although picturesque, are the most disheartening in all South America. In parts the road twists, turns, descends and ascends so much that twelve hours' driving may only cover 150 to 200 miles, and it was with great relief that we reached the bitumen surface at Cali, half way to Bogotá.

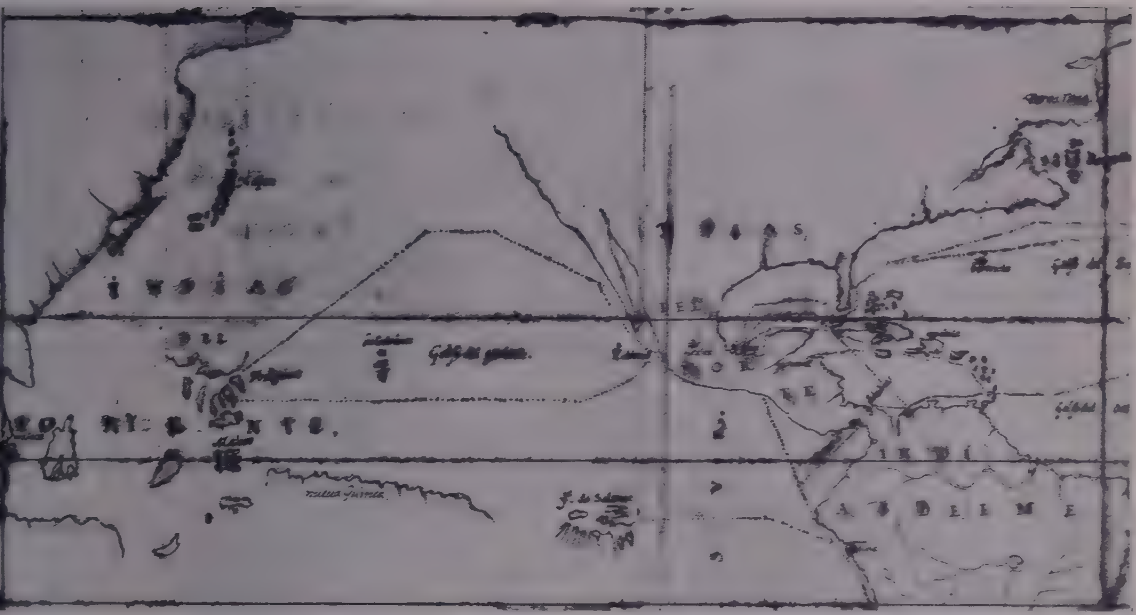
In contrast to most of the South American republics, Colombia has recently removed all control of civil aviation from military hands. The go-ahead nature of Colombia's aviation reflects this refreshing attitude. The largest company, AVIANCA, operates fifty large transport aircraft and has interests in two other companies, one using fifteen Beaver aircraft and another using twenty-three small helicopters, mainly for supporting the oil companies' seismic crews. To complete the scene in Colombia there are several helicopters, large fleets of aircraft for spraying the cotton and bananas, eighteen charter companies, thriving aero clubs and privately owned aircraft.

As in Africa, South America's high mountains and high temperatures restrict the performance of aircraft, but these difficulties are by no means insurmountable and light aviation, using mostly American aircraft, is firmly established, particularly in Brazil and the Argentine. The biggest problem in South America faces the domestic airlines, whose present low fares make it extremely difficult for them to replace old American transports. Rail and road fares are maintained at a ridiculously cheap level as they are subsidized by governments who will lose favour if they increase them; many riots in recent years have been started by increases in transport charges. Airlines are consequently forced to keep fares uneconomically low to attract customers. Only the government airlines can afford to buy new aircraft; eventually the supply of old wartime aircraft from America must run out, and this will produce much hardship and perhaps eliminate many companies.

Nevertheless, both these great continents, with sparse populations and not very highly developed or extensive road or rail facilities, are alike in being more easily 'covered' by air than by any other means. Use of the private aeroplane by the rich is already firmly established and continually expanding. The charter companies and airlines have an endless fight to beat higher operating costs, but most of them will have scope for gradual development, always provided that the politicians can maintain some degree of stability.

The Manila Galleons

by MARCO A. ALMAZÁN



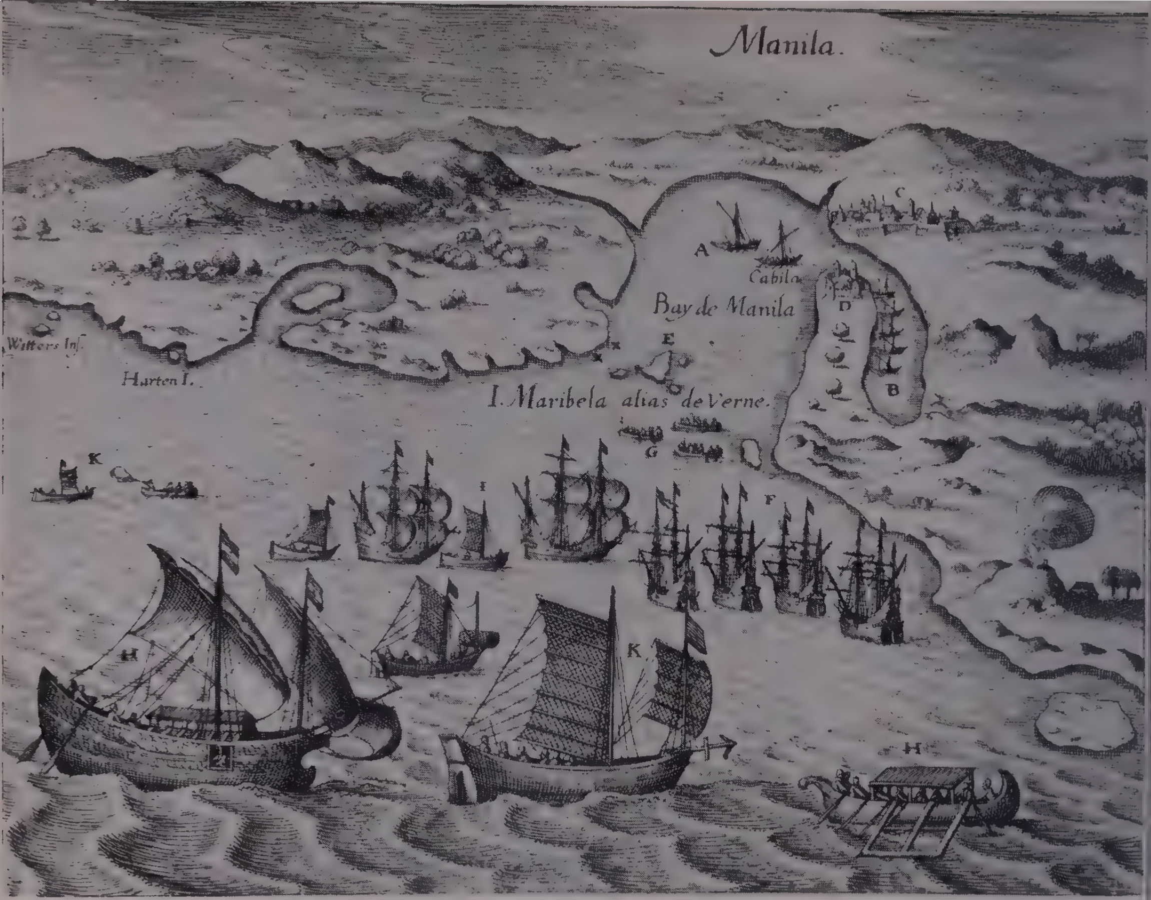
British Museum

A 16th-century Spanish map of the Pacific, showing the route from America to the Philippines taken by the Manila galleons, and the more northerly course by which they returned to Mexico

> 'Today, the twenty-second day of January of the year of Our Lord 1698, it pleased God that we made the coast of New Spain. Shortly after dawn we perceived the dim outline of the Sierra Madre, rising like a faint blue cloud out of the sea, and it was with indescribable joy that all men, women and children on board, even those who had been too ill or too weak to move from their berths for the last month or so, came on deck to watch how the coastline gradually turned into a dark green. At length we could distinguish the rocky promontories bordered with palm trees and a thick display of tropical foliage, and by noon-time the two jutting horns that guard the entrance to the magnificent bay of Acapulco were clearly in sight. We directed our course to them; and as the sun was setting on the far away line of the sea, and the emerald mountains seemed almost to hang over our ship, we came to anchor in a sheltered and lovely cove of the spacious bay, after a voyage of two hundred and four days from Manila, in the Philippines.'

Thus ended the diary of Gemelli Carreri, an Italian traveller who late in the 17th century undertook the 10,000-mile voyage across the immensity of the Pacific Ocean on one of the sturdy Spanish galleons that once a year, for 250 years, regularly plied between Manila and Acapulco, carrying the silver doubloons from the mints of New Spain, as Mexico was then called, to the Philippine Islands and bringing the treasures of the Far East to the Spanish colonies in America.

The Philippines had been discovered in 1521 by Ferdinand Magellan, a Portuguese navigator in the service of Spain. He proposed to reach the Spice Islands of the East Indies by sailing west, hoping to find a passage along the coast of the New World. For that purpose he sailed from Spain with a fleet of five vessels to the extreme south of South America, and after many months of hardship and adventure he discovered the strait that now bears his name. Entering the 'Great South Sea' (which he called the 'Pacific' from the steady and gentle winds that drove his ships across the vast expanse), Magellan sailed north and then west until he reached the Ladrone Islands (later renamed the Marianas) and then the Philippines. Here he was



All remaining reproductions, except two, from the National Maritime Museum

A plan of Manila drawn by De Bry in 1616, showing Manila itself and the fortress at Cavite. In the foreground are four Philippine vessels, and a Dutch fleet capturing some brigantines

well received by the King of Cebu, who was willing to become a Catholic and a vassal of the Spanish monarch provided the white men helped him against his enemy, the ruler of the neighbouring island of Mactan. Obligingly, Magellan set forth on a war expedition, but with such ill fate that he was killed by an arrow at the first encounter with the natives.

Shortly after Magellan's death, a number of Spanish expeditions were sent from Mexico to the Philippines with the purpose of conquering the whole archipelago, but none of them was able to return by the route they had taken, which was along latitude 10° N, where the North Equatorial current and the prevailing westerly trade winds greatly facilitated the crossing of the Pacific from east to west. The expeditionaries, therefore, were compelled either to remain in the islands or to go back to Spain by the Indian Ocean and the southern tip of Africa, a journey that the Portuguese and Dutch men-of-war seldom left unchallenged, as they both considered those seas their exclusive domain.

In consequence, it was decided to send a new and more carefully planned Spanish expedition, which by royal orders was 'to establish a permanent settlement in the islands and to find a speedy and safe route back to New Spain, in order to bring spices and other valuable merchandise'.

To accomplish this purpose, on November 20, 1564, a fleet of five ships ranging between 40 and 500 tons, with a force of 400 men under the Captain-General Don Miguel López de Legazpi, sailed from the little Mexican port of Navidad, directing their course, as usual, due south to the 10th parallel north and thence west 8000 miles across the whole length of the Pacific, until they reached Guam, in the southern Marianas, and finally the Philippines. The expedition landed

De Bry's drawing of 1615 of Acapulco, the Mexican port from which the Manila galleons sailed: its church still stands. A fleet of Dutch ships is handing over ransomed Spanish prisoners

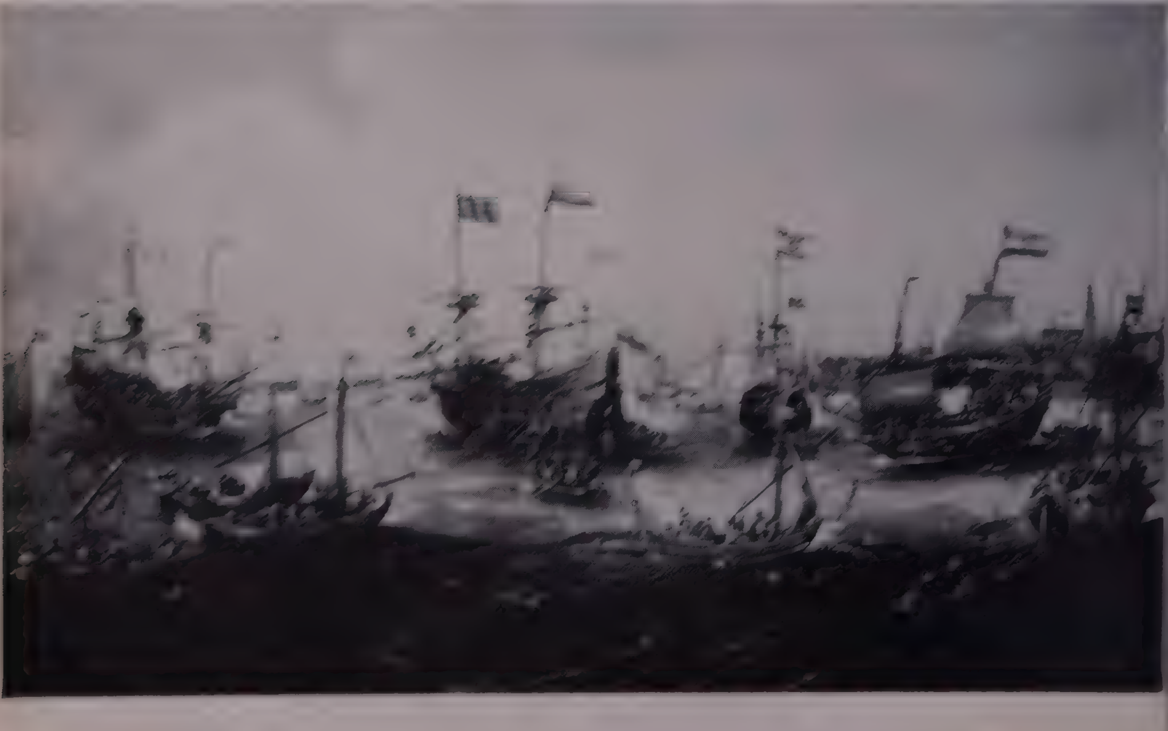
again in Cebu, from where Legazpi eventually subdued the main islands of the Philippine archipelago and founded the city of Manila, future capital of the new colony.

While the conquest of the islands was going on, Legazpi began making arrangements to carry out the second part of his instructions, that of finding a Pacific Ocean route back to Mexico. Among his men there was one of those individuals representative of the 16th-century Spaniards who discovered and conquered new worlds: a mixture of mystic and adventurer, of half-frenzied visionary and dogged, matter-of-fact realist. His name was Andrés de Urdaneta and at that moment he was an Augustinian friar, although most of his life he had been a navigator and explorer, and had twice crossed the Pacific from east to west in previous expeditions.

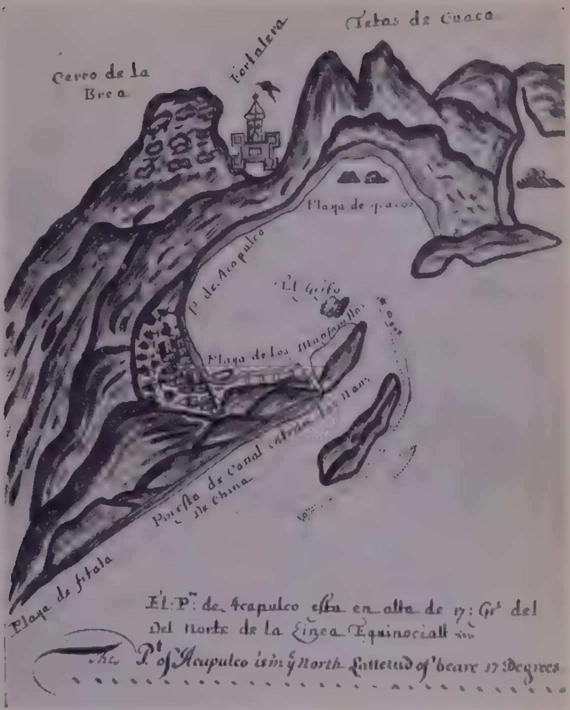
Urdaneta nursed the theory that, in the same way as there existed an easterly current in the North Atlantic (the Gulf Stream), there should be a similar flow in the North Pacific which, if found, would carry the vessels back to America from the Far East. Such was his settled belief and insistance on this point that Legazpi decided to take a chance and entrust him with his largest ship, the *San Pablo*, of 500 tons, the only one of the fleet that was in condition to undertake a lengthy voyage.

And so, on June 1, 1565, the monk-navigator sailed from Manila, directing his course to the north-east across unknown seas. Barely escaping the typhoons that at this time of the year sweep down from the Yellow Sea, the *San Pablo* fought her way against rising head winds and violent storms until she reached latitude 40° N, just off the coast of Japan. There the wind subsided, and the boat sailed into a thick blanket of fog. For two weeks the explorers could not see the sun, but to Urdaneta's great joy he noticed that the

The Manila galleons, with their immensely valuable cargoes, were a favourite target for many more-or-less illegal freebooters, and ships belonging to countries hostile to Spain, such as (above) Portuguese carracks of about 1521, armed, although ostensibly merchant ships, and (below) Dutch ships, here returning to Amsterdam in 1599 after a voyage to the East Indies



(*Right*) A 17th-century chart of Acapulco, showing the narrow channel through which the Manila galleons entered the harbour, and the most important landmarks. (*Below*) A profile of the Ladrones Islands (now the Marianas) with a plan of the harbour at Acapulco and another of Manila Bay, drawn up in the 18th century


Tetas de Guaca
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P. de Acapulco
El Grifo
Playa de los Manzanillos
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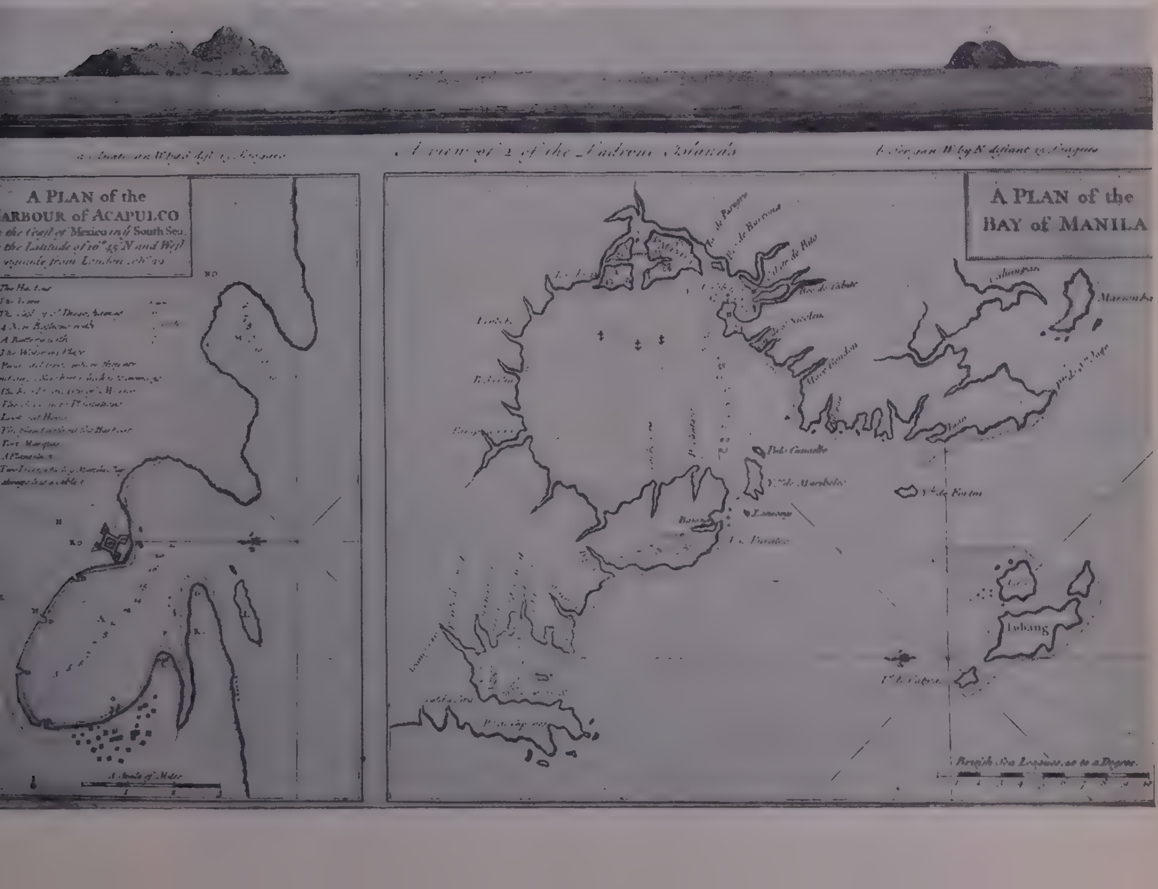
A View of 2 of the Ladrone Islands
A PLAN of the
ARBOUR of ACAPULCO
A PLAN of the
BAY of MANILA
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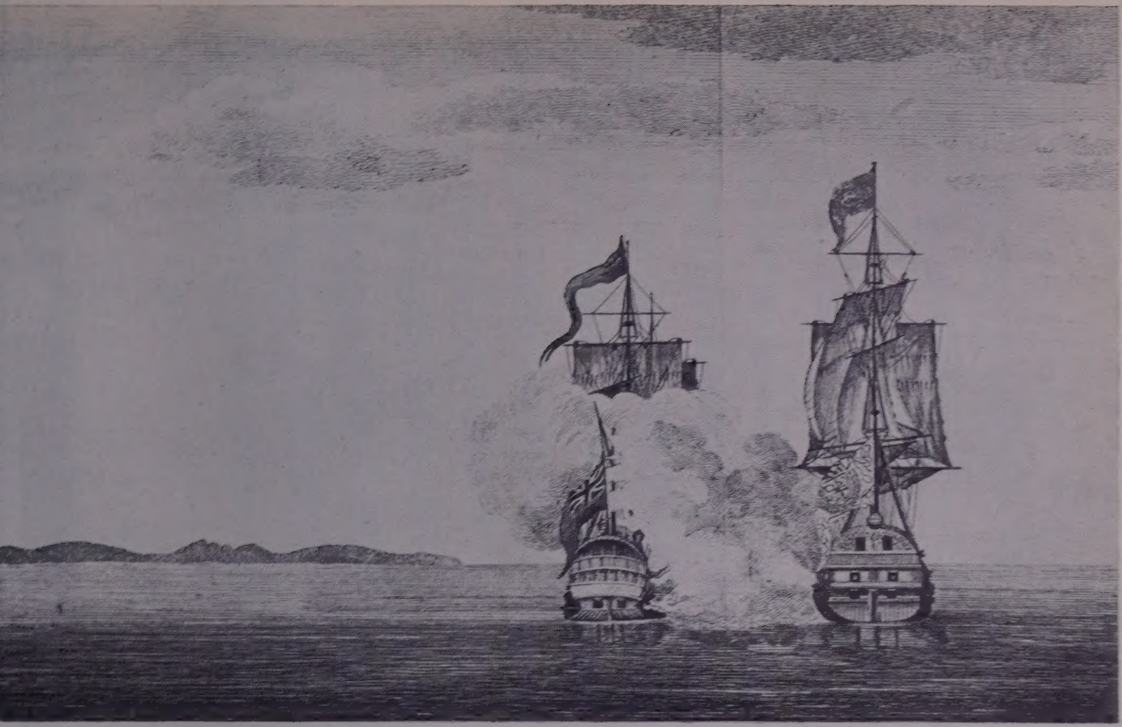
San Pablo was slowly but steadily drifting to the north-east. He knew then that his prediction had come true: the vessel had entered the Kuro Shiwo, the great warm current that originates along the southern shores of Japan and flows in a north-easterly direction across the Pacific until it merges with the West Wind drift and continues all the way down to the western coast of North America.

Leisurely the *San Pablo* sailed along the current, and 130 days after she had left Manila the coast of Lower California was sighted at 27°12′ N. From that point the vessel continued to the south-east, and a few days later she glided into the tranquil waters of Acapulco's bay. The return route from the Philippines to America had been found at last.

The discovery of this ocean lane was hailed as important news by the Spanish authorities, who immediately set out to organize a regular mari-

(*Left*) Thomas Cavendish, who, like Sir Francis Drake, sailed round the world plundering the Spaniards, took a Manila galleon off the coast of America in 1587. (*Below*) Cavendish's ships arriving in the Ladrones



On June 20, 1743, the British ship *Centurion*, commanded by Commodore George Anson, captured the *Nuestra Señora de Covadonga* off the Philippines, despite the galleon's superior armament

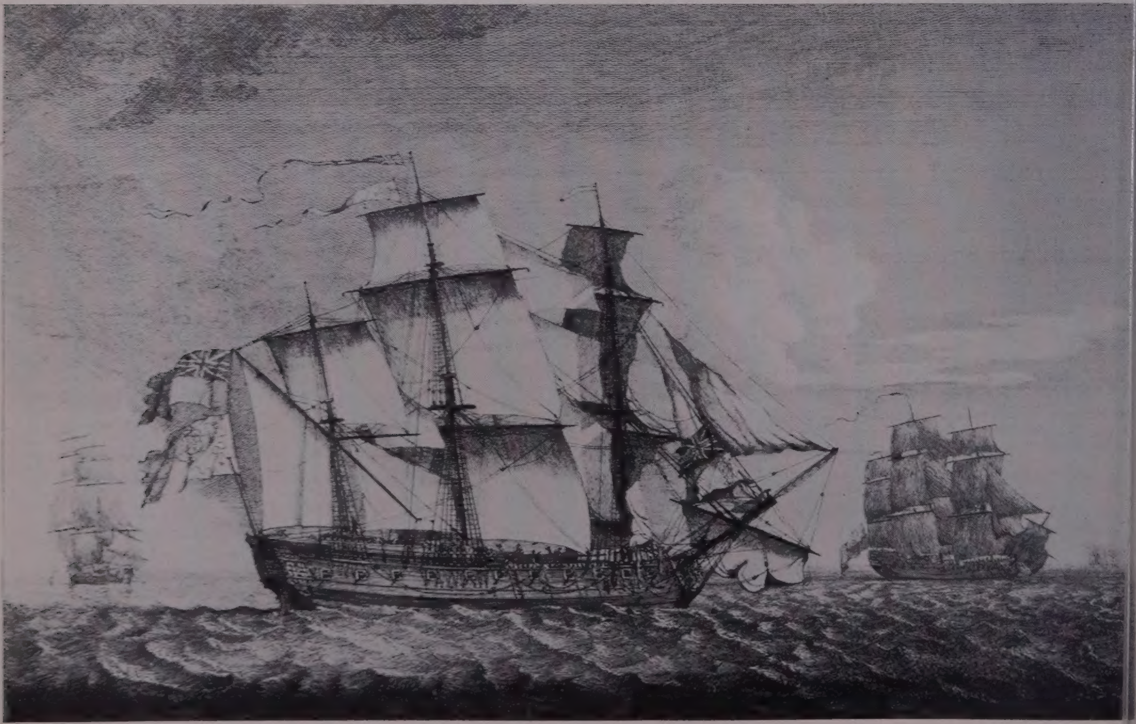
time service between the two distant colonies. For the first few years, two or three ships displacing between 40 and 80 tons crossed the Pacific annually, until in 1571 it was decided that a single, but larger, vessel should sail every year from Acapulco to Manila and back.

And so the romantic 'Manila Galleons' or 'China Ships', whose voyages were to be repeated without interruption for 250 years, came into being. With the characteristic inflexibility and minuteness of the Spanish laws of those times, everything concerning the ships and their crossings was rigidly regulated: the galleons were to displace 500 tons; they were to sail from Acapulco early in March and from Manila at the beginning of July, to avoid the seasonal typhoons. (The westbound trip lasted three months, while the return voyage took anything from six to seven, due to the great arc the galleons had to describe along the North Pacific.) The ships, too, could only carry silver from Mexico to the Philippines either coined or in bars, and bring back general merchandise to a top value of 250,000 pesos—which would be about £180,000 today—although in practice the value of the cargoes usually exceeded this amount. And finally, the China ships 'could not call at any other ports but those of Acapulco and Manila, unless in case of the greatest distress, nor could transport infidels or heretics, or persons who were not connected in one way or another with the service of His Catholic Majesty, the King of Spain'. The underlying idea behind all these regulations was to establish a trade monopoly and to keep out all foreign powers from the Pacific, and it is remarkable indeed to notice how well this policy worked out, considering that for the next two centuries, with the exception of occasional incursions from English, French and Dutch adventurers or explorers, the Pacific Ocean remained a veritable Spanish lake.

The first Manila galleons were built either in Spain or on the west coast of Mexico, but when it was found that the teak wood of the island of Jolo, in the Philippines, was a heavy durable timber that did not warp or shrink, and had excellent floating qualities, it was decided to establish a shipyard at Cavite, a forked tongue of land eight miles to the south of Manila.

At Cavite, then, under the direction of Spanish naval engineers, teams of Chinese and Filipino workers set the heavy keels, frames and beams

Spanish galleons were the best prizes, and the Atlantic routes were generally unsafe for them. (*Above*) The Dutch West India Squadron capturing two Spanish galleons from Honduras in 1628. (*Below*) The Spanish ship *Hermione* taken by two British vessels off Cape St Vincent in 1762



of the ships, which on account of the rough service they were called to perform, sailing for many months at a time through stormy seas and gusty winds, had to be of extraordinary solidity and sturdiness.

Originally the galleons' keels were three times their beam, with a graceful curved stem and a high three-decked after-castle, a structure better suited to the calm Mediterranean waters where the style had originated than to the tempestuous Pacific seas. Moreover, only twenty years after the Manila galleons had started their regular crossings, the English pirate Thomas Cavendish sailed from Plymouth in 1586 and, by way of the Cape Verde Islands and Brazil, coasted down to Patagonia, passed through the Strait of Magellan, and fell upon the Spanish settlements and shipping on the west coast of South and Central America. He plundered his way up to Lower California, where he captured the treasure galleon *Santa Ana* and made off with a booty of 22,000 pesos in coin and as much of the 600 tons of merchandise as he could carry. Shocked into action by this surprise attack, the Spaniards decided then to build larger galleons and to equip them with heavy armament, in order to resist further assaults.

In consequence, after 1588 the structure of the ships was modified: their displacement was increased from 500 to 1000 tons, the beam was widened to provide for better stability on the heavy seas of the North Pacific, and the gunwales were heightened to run at the same level with the fore- and after-castles, to make place for three rows of gun tiers. The new galleons were 130 feet keel by 43 feet beam and 22 feet draught, dimensions that allowed more steadiness at sea and a larger hold for the merchandise, as well as space for seventy guns, although the beauty of the original slim hull was somewhat altered and the speed and mobility of the craft considerably reduced.

From then on the Manila galleons were a combination of merchantmen and men-of-war, heavy and cumbersome, but thoroughly adequate to fight pirates, winds and waves. It is significant that, during the 250 years of their existence, only thirty galleons were lost, and this mainly in combat with pirates or in action of war. Such was their sturdiness that when Admiral Cornish—during one of the many conflicts between England and Spain—attacked the *Santísima Trinidad* in October 1761 just off the Philippine coast, the galleon resisted a three-hour fire from the British frigates *Argo* and *Panther*, and received more than a thousand 18- and 20-lb cannon balls without sinking. Admiral Cornish eventually captured the ship and took her to Plymouth, where she was on show for several months and admired by hundreds of visitors. The *Santísima*

A model in the Naval Museum in Madrid of the *Santa Ana*, one of the last and largest of the galleons built in the Spanish dockyards at Cavite

From the author

Trinidad measured 204 feet by 53·8 feet and displaced 2000 tons, and was considered the largest vessel in the world at that time.

The Manila galleons, at the peak of their glory, carried from 400 to 600 people, made up of passengers, soldiers and crew. On the westbound voyage the passengers were missionaries, colonists and government functionaries and troops who had been commissioned to the Philippines, while on the return trip the voyagers were mainly traders or discharged officials and soldiers on their way back to Spain.

Far more important than the conveyance of passengers, however, was the transport of goods. We have seen how on the westbound trip the galleons carried silver from the Mexican mines and mints. The weighty silver coins, called 'pieces-of-eight', were used to pay for the rich and varied products of the Asiatic continent and the East Indies that were so much in demand in Europe at that time: silks, tea and jade from China; ivory, jasper and sandalwood from India; cinnamon from Ceylon, clove and pepper from the Moluccas . . . all the treasures of Cathay and the Spice Islands were brought by Chinese junks and Malayan *prahus* into Manila, where they piled up in large warehouses waiting for the galleons to carry them across half the world.

The ships sailed with this merchandise and with the traders to whom it had been allotted, and slowly ploughed their way for many months through the vastness of the Pacific, fighting tempests and gales, keeping off treacherous reefs and the forbidden coasts of Japan, whiling away dead calms, smouldering under the fiery tropical suns or freezing in the polar winds and blizzards of the high latitudes.

One of the main problems was that of fresh water: this was stored away in skins or large earthenware jars, and there was an officer—usually the most hated man on board by the end of the voyage—in charge of its distribution. Naturally, it was only to be drunk.

As for food, it consisted mainly of hard biscuits that soon rotted and got full of maggots, pancakes made out of flour baked with salt water, and salted beef or pork, although during the first weeks of navigation there was fresh meat and milk from cattle embarked for that purpose. By the end of the voyage there was another kind of fresh food: after six months at sea, the rats that plagued the ships were considered a delicacy by the half-famished travellers.

At long last, provided that pirates had not preyed upon them (or if they had made an appearance, had been scared away by the guns of the pot-bellied ships), the coast of California was sighted, sometimes as far north as Cape Mendocino, but usually at the latitude of Santa Barbara or San Diego. Inland runners were dispatched all the way southward to convey the happy tidings, and by the time the galleon sailed into Acapulco Bay there was a multitude waiting for it.

As the China ship dropped anchor, His Catholic Majesty's officials came on board and checked the cargo. Then, together with passengers and crew, they proceeded ashore to attend a solemn *Te Deum* at the little white church that still stands in modern Acapulco, and afterwards the treasures of the East were finally unloaded and displayed at a noisy fair.

For two or three weeks the sleepy little town throbbed with life and activity as traders from all over the country bid for the porcelains and silks, the ivory and spices, paying five and six times their original cost. Once the transactions were completed, off they went with heavily burdened mules stumbling before them on the long, hard journey to Mexico City and Veracruz, where the goods were reloaded on vessels of another fleet and shipped all the way across the Atlantic to distant Spain.

Late in the 18th century, however, conditions began to change. In 1785 the Royal Philippine Company was established in Spain and was granted the privilege of trading directly between Cadiz and Manila by way of the Cape of Good Hope and the Indian Ocean, a lane no longer disputed by other maritime powers. After the Napoleonic wars, Spain opened the Philippines to foreign trade, and a number of British, Dutch and eventually American firms established themselves in Manila, shipping the Oriental goods directly to their home lands on their own boats. Moreover, in 1810 New Spain, having become of age, revolted against the mother country and started the long struggle from which she was to emerge as the fledgling Republic of Mexico, a process that interrupted communications between the Philippines and Spain by way of the American continent.

The ocean route between Manila and Acapulco thus became obsolete. In 1815 the last galleon swung into the green harbour of Acapulco, dropped anchor, furled her canvas, and never again sailed the Pacific Ocean.